NOTES

There documents are shipbuilding quality standard implemented by our yard presently. They consist of two parts like **QUALITY CONTROL THROUGH PRODUCTION** and **CONSTRUCTION ACCURACY** Taken as a main basis for the shipbuilding in our yard, this construction accuracy is made according to the shipbuilding quality standard in advanced shipbuilding nations, international conventions as well as rules and regulations of some well-known classification societies. For this purpose, we require:

1. detailed workmanship and drawings, if no other specific restriction, comply with the respective requirements stated in this **STANDARD**. In case of difference, this **STANDARD** shall govern all.
2. should there be some items in the newbuilding contract or technical specification of higher requirement than this **STANDARD**, these items should be regarded as an exception and performed according to specific requirement otherwise announced.

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PART 1

QUALITY CONTROL THROUGH PRODUCTION

1 STEEL MATERIAL AND PROCESSING

1.1 Steel material

1.1.1 Upon arrival in the yard, all marine steel materials are to be checked against quality certificates. Visual inspection is to be done to confirm their quality.

1.1.2 All steel materials are to be stowed in pile according to sizes and brand and kept flat.

1.1.3 All steel materials shall be served out against material allocation sheet according to the production plan.

1.1.4 Visual inspection is to be done to the steel materials before processing.

1.1.5 Key points of quality control:

a) size, brand, heat number, batch number;
b) minus tolerance in thickness for plates and sections;
c) surface qualities;
d) any defects in large forgings and castings.

1.2 Steel processing

1.2.1 Marking and cutting

1.2.1.1 Necessary pre-treatment such as levelling, straightening and derusting are to be done to the plates and sections before cutting.

1.2.1.2 Numerical controlled cutting and other high efficient high-precision cutting means are to be used as far as possible to improve marking and cutting accuracy.

1.2.1.3 Material property, heat number, batch number and thickness are to be noted down for primary members according to the requirement.

1.2.1.4 Key points of quality control for marking:

a) size deviation;
b) anglar deviation;
c) markings such as processing symbols, codes and marks.

1.2.1.5 Key points of quality control for cutting:

a) cutting accuracy;
d) dimensional size;
e) lamination.

1.2.2 Forming

1.2.2.1 Bending

Forming by cold or hot bending of steel plates and sections is to be performed according to the specified requirements for materials of different properties

and grades.

1.2.2.2 Key points of quality control:

a) heating temperature;

b) accuracy of forming.

2 FIXING AND ASSEMBLING

2.1 Fixing and assembling of parts and members

2.1.1 The accuracy requirements of block assembling is to be met for the fixing and assembling of parts and members. Shop pnmer is to be applied after welding.

2.1.2 Key points of quality control:

a)geometrical dimensions of parts and members;

b) installation locations;

c)deformation.

2.2 Block assembling

2.2.1 Block assembling is to be generally carried out on the platform or jig.

2.2.2 Pre-outfitting of parts and members is to be done according to the design drawings.

2.2.3 The accuracy that meets the requirements of general assembling is to be applied for block assembling.

2.2.4 Block assemblies are to be painted after inspection.

2.2.5 Key points of quality control:

a) marking accuracy;

b) installation accuracy of internal structure joints inside the block;

c) accuracy of block configuration and its dimensional size;

d) accuracy of block edges;

e) correctness of assembling reference lines;

f) levelness of face plate and location deviation of main engine bed;

g) installation locations of key components, such as shaft boss, rudder horn, etc;

h) accuracy of jig manufacturing

2.3 Erection on shipway

2.3.1 Carry out marking on the shipway with corresponding symbols and marks.

2.3.2 Place the reference block in position, and then proceed with successive blocks according to the shipway assembling schedule.

2.3.3 Carry out erection on shipway.

2.3.4 During construction process, all temporary openings in the primary members and their closing-up are to comply with the requirements set out in the technical documents.

2.3.5 Remove temporary welding pieces and lifting eye pieces according to usual practice.

2.3.6 After completing shipway assembling, the hull is to be painted according to the specified requirements.

2.3.7 Key points of quality control:

a) accuracy of marking on the shipway;

b) correctness of location of the reference block

c) frame spacing at block junctions;

d) alignment accuracy of structural members;

e) deflection of the centerline of the keel;

f) alignment accuracy of shaft centerline;

g) marking accuracy of loadline and draft marks;

h) principal dimensions of the hull.

3 WELDING

3.1 Preparation before welding

3.1.1 Welding materials, preparation of weld joints and assembling accuracy are to comply with relevant requirements set out in quality control documents.

3.1.2 The welding zone is to be free of rust, scales, grease, moisture or other dirty.

3.1.3 The environmental condition of the welding area is to be kept in good order.

3.1.4 Tack welding is to be carried out according to specified technological procedures.

3.1.5 Wherever new materials or new welding technologies are adopted, test reports and welding procedures are to be submitted to the classification society for approval.

3.2 Welding process

All welding shall be carried out according to the methods and conditions as required by the welding technology procedures. Proper measures for minimizing welding deformation are to be taken.

3.3 Welding inspection

3.3.1 Inspection of welding is to be carried out throughout the whole process of welding including inspections before, during and after welding as well as the inspection of finished weldments.

3.3.2 All welds are to be visually examined first.

3.3.3 Quality inspection of welded seams is to be carried out according to the specified requirements. Either X-ray detection, ultrasonic detection or other inspection methods approved by the classification society may be adopted.

3.3.4 Leg sizes of fillet welds are to comply with the design plan and relevant

codes.

3.3.5 Welded joints on the strength deck, shell plate and interior strength members in the mid-length region are to be inspected in accordance with the non-destructive inspection plan approved by the classification society.

3.3.6 Welds not conforming to the requirements of quality standards are to be rectified and repaired as required, and are to be inspected again.

3.4 key points of quality control

a) qualification of welders;
b) welding materials;
c) welding codes;
d) groove sizes and seam clearance;
e) cleanness of welding region;
f) preheating and heat-retaining;
g) welding deformation;
h) sizes of welded seams;
i) integrity of all-around welds;
j) surface and inner defects in welding seam.

4 TIGHTNESS TEST

4.1 Tightness test is to be conducted after main hull and the structure to be tested are completed, all accessories affecting the tightness are fixed and non-destructive testing are properly completed.

4.2 All welding seams having concern with tightness test are to be free of scales, slugs, paints(excluding primers)or any grease.

4.3 Tightness test to the hull structure may be performed with either hose test, hydraulic test, air test or other equivalent methods depending upon the hull strength and tightness requirement.

4.4 Tightness test may be performed on blocks.

4.5 The location and requirements for tightness test are to be in compliance with the requirements of the classification society.

4.6 Key points of quality control:

a) cleaning of welded seams;
b) test pressure;
c) test procedure;

d) test duration;
e) inspection for deformation and leakage.

5 FABRICATION, FIXING, TIGHTNESS TESTING AND FLUSHING OF PIPES

5.1 Fabrication of pipes

5.1.1 Material of pipes

5.1.1.1 Upon arrival in the yard, visual inspection is to be conducted to the pipes against technical documents. The pipes are to be properly stowed separately according to their material quality, heat number, batch number, grade and size.

5.1.1.2 Key points of quality control:

a) certificate of qualification;
b) size and visual appearance;
c) separate stowing.

5.1.2 Blanking of pipes

5.1.2.1 Before blanking, check is to be made to the pipe size, grade, material quality, heat number and batch number. After blanking and temporary sealing, the pipe sections are to be properly numbered and stowed in accordance with technical document.

5.1.2.2 Key points of quality control:

a) size and visual appearance;
b) blanking length and serial number;
c) stowing and maintenance.

5.1.3 Bending of pipes

5.1.3.1 Either cold bending or hot bending may be used for pipe bending. In case of cold bending, the bending radius of the curvature of the pipe is to be in general not less than three times the outside diameter of the pipe. For special pipes such as tank heating pipe and pipes to be fixed in confined space, the radius of curvature is to be in general not less than two times the outside diameter of the pipe. When pre-fabricated bend is adopted, the bending radius of the curvature is to be not less than the outside diameter of the pipe.

5.1.3.2 Key points of quality control:

a) circularity of the pipe bend;
b) height of bending corrugation of the pipe bend;
c) mechanical damage or defect;
d) bend angle, rotating angle and length of pipe segment after bending.

5.1.4 Fixing of pipes

5.1.4.1 The material, size and type of pipe fittings are to be in compliance with the requirements of the technical documents. The mating clearance or groove of the pipe

with its connector, of the branches with main pipe and between connection butts of pipes are to be in conformity with the relevant technical requirements.

5.1.4.2 Key points of quality control:

a) marks of pipe;
b) correct use of connector;
c) mating clearance and groove;
d) assembling dimensions;
e) position welding.

5.1.5 Welding of popes

5.1.5.1 The welder shall hold proper qualification certificate for conducting welding. Measures are to be taken to avoid deformation of the welding for large diameter pipe. Welding is to be carried out in accordance with the requirements of the welding procedures.

5.1.5.2 Key points of quality control:

a) cleaning of welded parts;
b) welding material;
c) welding deformation;
d) welding quality.

5.1.6 Pipe cleaning and strength testing

5.1.6.1 The pipes are to maintain smooth surface after machining and welding, and are subject to hydraulic test in accordance with the requirements of the technical documents.

5.1.6.2 Key points of quality control:

a) no welding slag, spray, sharp cut nor burr on the surface;
b) strength test;
c) seal blocking of pipe ends.

5.1.7 Surface treatment of pipes

5.1.7.1 After machining, pipe surface is to be treated in accordance with the requirements of the technical documents. Pipes with different surface treatment shall be segregated and stowed separately.

5.1.7.2 Key points of quality control:

a) cleaning and protection of pipes;
b) quality of galvanizing and painting;
c) stowing of pipes after surface treatment.

5.2 Fixing of pipes and fittings

5.2.1 Handling of pipes

5.2.1.1 Pipes to be installed are to be counted and served out in accordance with the technical documents.

5.2.1.2 Key points of quality control:

a) protection of non-ferrous and specially treated pipes;

b) prevention of impact or squeezing;
c) prevention of sand or dirt from entering the pipe.

5.2.2 Fixing of pipes

5.2.2.1 Pipes, in general, are to be fixed in stages of unit assembling, block assembling, overall assembling and fixing on board.

5.2.2.2 Key points of quality control:

a) fixing sequence and accuracy of coordinate dimensions;
b) cleaning of pipe end mating surface and removal of foreign matters inside the pipe;
c) size and material quality of pipe connection bolt;
d) sealing material for pipe connection;
e) connecting accuracy of pipe to equipment.

5.2.3 Fixing of pipe fittings and supports

5.2.3.1 The fixing of pipe fittings and supports is to be in compliance with the requirements of the classification society.

5.2.3.2 Key points of quality control:

a) type, size, position and flow direction of pipe fittings;
b) visual quality of fittings;
c) connecting accuracy of pipe to the equipment;
d) supporting type and spacing of supports;
e) welding of support;
f) gasket between non-ferrous pipe and support.

5.3 Tightness testing of piping system

5.3.1 Tightness test of the piping system is to be carried out in accordance with the technical documents.

5.3.2 Key points of quality control:

a) completeness and accuracy of pipe fixing;
b) testing medium;
c) testing method;
d) tightness.

5.4 Flushing of pipes

5.4.1 Flushing of the piping systems is to be carried out in accordance with the requirements of the technical documents.

5.4.2 Key points of quality control:

a) flushing medium;
b) flushing method;
c) cleanness.

6 PAINTING

6.1 Pre-treatment of steel surface

6.1.1 Surface pre-treatment of steels in to be done in general by means of shot-blasting, abrasive blasting and chemical cleaning. Shop primer is to be coated after derusting.

6.1.2 Surface pre-treatment is to be done to the quality standard listed in table 3-5-1 of this standard.

6.1.3 Shop primer is to be applied to the quality standard stated in table 3-5-2 of this standard.

6.2 Shop primer touch-up

Any damaged shop primer is to be duly touched up during processing, assembling and welding.

6.3 Secondary derusting and surface cleaning

Secondary derusting and surface cleaning are to be done to the quality standard stated in table 3-5-3 and table 3-5-4 of this standard.

6.4 Painting work

6.4.1 Pre-painting

Pre-painting is to be done for the spots and areas that can not be easily accessed or difficult to reach the required film thickness by spraying.

6.4.2 Painting

Painting may be done by means of either airless spraying or roller application, etc.

6.4.3 Key points of quality control:

a) environmental conditions affecting painting operation;
b) appearance of coat;
c) wet film thickness or dry film thickness;
d) film thickness allocation.

7 HULL OUTFITTING

7.1 Pre-outfitting of ship equipment

Pre-outfitting is to be carried out as extensive as practically possible depending upon the conditions of contruction.

7.2 Approval of ship equipment

All ship equipment such as hatch covers, closing appliances for windows and doors, air-conditioning system, fire-fighting system are to have the marine product certificates issued by the classification society, product qualification and test reports.

7.3 Installation of ship equipment

All ship equipment are to be completely and correctly installed.

7.4 Key points of quality control:

7.4.1 Steering equipment

a) machining accuracy of all fitting faces;
b) machining accuracy and mating gaps for rudder stock, rudder plate, tiller, rudder carrier, rudder pintle and liner;
c) location deviations of various centerlines of rudder system;
d) correct zero position of rudder blade;
e) installation precision of the steering gear.

7.4.2 Anchoring equipment

a) installation precision of the windlass;
b) smooth engagement of anchor chains with chain wheel;
c) braking ability of chain stopper;
d) mating of anchor to anchor lips.

7.4.3 Mooring equipment

a) precision of installation;
b) ease of operation

7.4.4 Lifeboat davits

a) strength of boat davits;
b) no part of boat extruding overboard;
c) clear observation of boat-lowering and hoisting from the boat handling station;
d) distance between boat and side shell when lowering; smoothness of boat lowering;
e) simultaneous de-hooking when the boat is afloat;
f) correct installation of boat winches and accessories.

7.4.5 Accommodation ladder

a) strength of ladder;
b) easy and reliable lowering, hoisting and turning over.

7.4.6 Cargo gear

a) fabrication accuracy of derricks and derrick post;
b) levelness and flatness of derrick post flanges and crane seat;
c) Precision of cargo winch installation;
d) braking reliability;
e) loading test of cargo gear.

7.4.7 Cargo hold hatch covers and hatch coamings

a) accuracy of sizes and shapes; installation accuracy of water-tight rubber seals and their channels;
b) precision of position limiting;
c) fitness between securing wedges and wedge seats;

d) flatness of face plates on hatch coaming; difference between diagonals of hatch;
e) location of battens on hatch coaming;
f) water-tightness of hatch covers;
g) easy handling.

7.4.8 Steel weather-tight closing appliances

a) visual quality after welding;
b) tightness.

7.4.9 Air-conditioning system

a) installation integrity and correctness of equipment, ducts and fittings;
b) smoothness and tightness of ducts;
c) running test to prove normal operation;
d) effect of air-conditioning.

7.4.10 Fire-fighting system

a) installation integrity and correctness of equipment, piping and fittings;
b) tightness of piping;
c) correct function and effectiveness of CO_2 or foam system;
d) correct functioning of fire-detection and alarm system;
e) releasing interlocking function.

8 MACHINERY INSTALLATION

8.1 Shafting and propeller

8.1.1 Machining and assembling of shafting

8.1.1.1 The materials of intermediate shaft, tail shaft and connection bolt are to be in compliance with the requirements of the classification society and with the qualification certificate.

8.1.1.2 The cone end of the tail shaft is to be machined against the templet.

8.1.1.3 For key-fixing propeller, the grind-fitting of the key with shaft and propeller keyways is to be carried out at the same time of the grind-fitting of the propeller boss and shaft.

8.1.1.4 After machining, the reamed bolt hoie of the connection flange is to be matched with the reamed bolt by cold or hydraulic pressing for interface checking.

8.1.1.5 The intermediate shaft is to be assembled by grind-fitting to the intermediate bearing.

8.1.1.6 The propeller is to be assembled by grind-fitting to the propeller shaft. The mating position of the propeller and shaft is to be marked.

8.1.1.7 Key points of quality control:

a) tolerance of templet for tail shaft cone part machining and amount of deformation;
b) accuracy of reamed hole of connection flange and centering deviation of flange;
c) contact point and clearance of grind-fitting bearing bush;
d) contact point and fixing tightness of grind-fitting key with shaft and propeller

keyways;

e) contact point and fixing tightness and assembling temperature of grind-fitting boss of keyless propeller with shaft;

f) tightness test.

8.1.2 Centering and position fixing of shafting

8.1.2.1 The centering of the shafting is to be done in general by using the way of optical sight or running a line. The optical instrument used is to be accurate and in good condition and such centering is to be carried out at the time without direct sunshine.

8.1.2.2 Before conduction shafting centering, all hull construction behind engine room fore bulkhead and below main deck or continuous strength deck are to be completed. The stern tube is to be centered, fixed and welded to completion based on ship’s centerline duly surveyed and qualified.

8.1.2.3 During the process of shafting centering, any work that may cause sever vibration and lifting operation of heavy piece are to be forbidden.

8.1.2.4 After centering, check the vertical distance of the shafting center to the face plate of the foundation of main engine and to the face plate of bedding support of intermediate bearing, the deviation at fore and aft and the machining tolerance of the stern boss are to be checked.

8.1.2.5 Reference position for boring is to be defined.

8.1.2.6 Key points of quality control:

a) deviation of center of boss at fore and aft ends;

b) deviation of shafting centerline from the rudder stock centerline.

8.1.3 Boring of stern tube and machining of stern bush

8.1.3.1 The deviation of the center of the boring bar from the shafting center is to be kept within the specified range.

8.1.3.2 After completing boring of stern tube, the deviation of its centerline from the fore and aft reference center points is to be rechecked.’

8.1.3.3 The external circle of stern bush is to be machined in accordance with the actual size of the bush after boring.

8.1.3.4 Key points of quality control:

a) flexibility of boring bar;

b) roundness, cylindricity and coaxiality of fore and aft stern bearing holes;

c) perpendicularity of end face of stern tube to the centerline;

d) fixing interference of stern tube with stern bush;

e) position mark of stern tube;

f) surface roughness of stern bush.

8.1.4 Shafting installation on shipway

8.1.4.1 The stern tube is to be normally assembled and mounted with hydraulic pressing. Before pressing-in, the dimensions of mating parts of stern tube and bush are to be checked under the same temperature. During the pressing-in process, the

pressing-in force is to be in compliance with the requirements of technical document.
Key points of quality control:

a) accuracy of positioning of stern bush into the boss;
b) temperature of stern tube and stern bush;
c) variation of bearing internal diameter after pressing-in and surface quality of babbit metal;
d) pressing-in force.

8.1.4.2 Before assembling the tail shaft, the completeness of stern sealing device and correct assembling of the temperature sensor and conductor are to be checker.
Key points of quality control:
Clearances of both fore and aft bearings.
8.1.4.3 The propeller is to be mounted by hydraulic pressing. After propeller mounting, the initial data of subsidence of the tail shaft sealing devices is to be measured and marked.
Key points of quality control:

a) temperature of tail shaft and propeller;
b) initial pressing force, pressed-in amount and pressure;
c) assembling tightness of propeller cap;
d) gravity oil filling test for tail shaft sealing device.

8.1.5 Alignment and installation of shafting
8.1.5.1 Shafting alignment is to be carried out with main engine, shafting and accessories all located, with in general other large machines and equipment in engine room all properly positioned, and after the ship is launched.
8.1.5.2 The assembling dimensions of the shafting are to be adjusted from aft end foreward according to the results of shafting alignment calculation, and the position of intermediate shaft and main engine are to be decided.
8.1.5.3 The grounded liners and reamer bolts are to be assembled and tightly fastened.
8.1.5.4 After finishing of the shafting installation, load re-checking for the intermediate bearing is to be carried out in accordance with the loads specified in shafting alignment calculation.
8.1.5.5 Key points of quality control:

a) deflection and offset of flange of each shaft;
b) contact point of grind-fitting liner;
c) surface roughness and mating accuracy of reamer bolt;
d) clearance between mating surface after installing and fastening;
e) load of intermediate shaft.

8.2 Main engine and accessories

8.2.1 Requirements to be followed for main engine positioning
8.2.1.1 Position of bolt holes in the main engine foundation along the longitudinal

direction are to be decided and machined.

8.2.1.2 The welding liners on face plate of main engine foundation are located and welded, or resin chock is bonded.

8.2.1.3 Main engine is to be assembled in accordance with the technical specification. Crank web deflection is to be measured.

8.2.2 Positioning of main engine

8.2.2.1 The main engine is to be positioned with reference to the shafting centerline.

8.2.2.2 The required thickness of adjustable liner is to be measured and machined to the required value. In general, the liner can be made of steel or cast iron. Epoxy-cast plastic liner may be used according to the specific procedures defined by the maker.

8.2.2.3 Bolt holes are to be machined and corresponding reamer bolts are to be prepared. Or tensile bolts are to be used.

8.2.2.4 The installation of main engine is to be carried out in accordance with specified procedures. The foundation bolts are to be fastened.

8.2.2.5 Key points of quality control:

a) contact point of grind-fitting liner, clearance between contact surface after fastening and mating of welded liner;
b) accuracy of dimensions, surface roughness, circularity and cylindricality of reamer bolts;
c) tightening moment or tensile force for fastening of the foundation bolts;
d) crank web deflection of main engine;
e) alignment accuracy, deflection and offset of flange at output end.

8.2.3 Installation of accessories

8.2.3.1 The fixing of lateral bracing and the installation of thrust block at output end of the main engine are to be carried out in accordance with the design drawings.

8.2.3.2 Key points of quality control:

a) welding deformation;
b) contact point, clearance and taper of grind-fitting liner.

8.3 Auxiliary machinery

8.3.1 Category of auxiliary machinery and basic requirements on installation.

8.3.1.1 For the first class auxiliary machinery such as diesel generating set and steam turbine set etc, the alignment is to be done to the required standard. Before tightening the fastening bolts, the clearance between the contact surfaces is to be measured with feeler gauge.

8.3.1.2 For the second class auxiliary machinery such as fresh water pump etc, the fixing of the pump frame to the engine seating and the tightness of connection bolts during installation are to be checked.

8.3.1.3 For the third class auxiliary machinery such as filter and heat exchanger etc, the tightness of fastening bolt during installation is to be checked. For the complete packaged equipment, the installation quality may be checked in the workshop.

8.3.2 Installation of diesel generating set

8.3.2.1 The crank web deflection of the diesel engine is to be measured at cold condition and shall be in compliance with the recommended standard of the technical specification.

8.3.2.2 In case the diesel engine and generator are installed separately, their alignment is to be checked to confirm that they meet the required standard of the technical specification.

8.3.2.3 The crank case is to be kept clean from foreign matters.

8.3.3 Installation of steam turbine set

8.3.3.1 Generally, the centering rechecking of the steam turbine set is to be carried out after the launching of the ship.

8.3.3.2 If the steam turbine and the driven machine are installed separately, their shaft centers shall be precisely aligned.

8.3.3.3 Special tools are to be used in installing the steam turbine set. After the installation, the closeness of the liner, fixing of the fastening bolt, engagement of gears and fixing accuracy of piping connection are to be checked.

8.3.4 Key points of quality control:

a) clearance between close contact liners;
b) tightness of bolt connection;
c) axial clearance;
d) easy rotating by hand turning.

8.4 Boiler

8.4.1 Installation of boiler

8.4.1.1 Before installing the boiler, the integrity of the boiler and its accessories are to be checked against certificate of the classification society and shop test report.

8.4.1.2 After fastening, the foundation bolts are to be checked to ensure their robustness and reliability. The bolts are to be fitted with locking devices.

8.4.1.3 The compensating connection pipe etc. used for the exhaust pipe are to meet the technical requirements of the bellow. Either rigid or elastic support is to be reasonably arranged.

8.4.2 Key points of quality control:

a) clearance between liner and bolt;
b) tension of support, bracing and pulling ring;
c) pre-tension of compensating connection pipe.

9 ELECTRIC INSTALLATION

9.1 Electric fittings

9.1.1 Electric fittings consist of cable supporters, cable penetrations and equipment supporters, etc. in general, standard fittings are to be used. The cable penetrations are

to meet the watertight and fire-proof requirements for the places of application.

9.1.2 Key points of quality control:

a) selection of cable penetrations;
b) span of cable supporter;
c) welding;
d) painting.

9.2 Cable laying

9.2.1 Cables are to be laid at a distance away from heat source. Heat insulation measures are to be taken where necessary.

9.2.2 Cables for emergency switchboard are normally not to be laid through the engine room where they have no concern with.

9.2.3 Cables having no concern with explosion-proof rooms such as battery room, paint room, etc. are not to pass through such spaces.

9.2.4 Cables for two sets of steering gears are to be laid separately as far apart as possible.

9.2.5 Cables of int6rinsic-safe circuits are to be laid separately from other cables.

9.2.6 Cables laying aboard oil tanker are to be in compliance with the special requirements for oil tanker.

9.2.7 Cables are not to be laid closely embedded inside the insulation. Cables for refrigerated spaces are to be laid uncovered.

9.2.8 The material of cable fittings are to be selected according to the locations of their application.

9.2.9 Cable tray on supporting bracket may have 1 to 3 layers, and cables on the tray are to be fastened in bundles.

9.2.10 The total sectional area of cables in the cable duct is not to exceed 40% of the inner sectional area of the duct.

9.2.11 Void space is to be retained between the cables and between the cables and wall of cable trunk when the cables are laid through the cable trunk with fire-proof stuffing box. The total external sectional area of cables is not to exceed 30% of the inner sectional area of the trunk.

9.2.12 Cables passing through packing or cast inorganic packing are to meet the watertight and fire-proof requirements for the places of their application and are to be provided with approval certificate issued by the classification society.

9.2.13 Key points of quality control:

a) cable allocation;
b) cable protection;
c) cable penetration and sealing.

9.3 Installation and earthing of electric equipment

9.3.1 The enclosure protection grade for the electric equipment is to meet the

requirements for the places of their installation. For equipment installed in dangerous zones and spaces, the explosion protection type of the equipment is to meet the requirements for that location.

9.3.2 In general neither pipe flange nor valve pieces is to be arranged above the electric equipment.

9.3.3 Electric equipment is to be installed even and upright at proper height for convenient operation and maintenance.

9.3.4 All electric equipment are to be earthed with special earthing conductors or through the base of the equipment installation. Effective contact is to be ensured. The sectional area of the earthing conductor is to meet6 the relevant requirements of the classification society.

9.3.5 Key points of quality control:

a) installation location and degree of protection;
b) installation accuracy;
c) equipment earthing.

9.4 Connection and earthing of metal coverings of cables

9.4.1 The enclosure protective property of the equipment is not to be inpaired when the cable is laid into the electric equipment.

9.4.2 Clear and durable marks are to be provided according to the design drawings at the core ends in connecting the cables.

9.4.3 Special tools are to be used for cold-pressing and connecting of wire terminals. Wire connection are to be tidy and protected against loosening.

9.4.4 In case the cables of both the intrinsic-safe and non-intrinsic-safe circuits are connected into one equipment, their cores are to be kept apart.

9.4.5 Metal sheath of the cable are to be effectively earthed at both ends. In safe region, cable of final branch circuit may be earthed at the source end only.

9.4.6 Cables of the intrinsic-safe system and of the signal and instrumentation system may be grounded at one end according to the requirements of their technical specification.

9.4.7 Key points of quality control:

a) treatment of cable connecting terminal;
b) grounding of cable metal covering;
c) correctness of cable lead-in and connection,

10 AUTOMATIC CONTROL AND REMOTE CONTROL, TELEMETRY EQUIPMETN AND THEIR TESTING

10.1 Sensors

10.1.1 Temperature sensors may be tested by means of either heating method or

analogue method. Pressure sensors may be adjusted and tested while the system is in operation or tested with test pump. Liquid level sensors and signal transducers are to be tested by analogue method.

10.1.2 Key points of quality control:

a) setting value;
b) setting position mark;
c) locking of adjusting screw.

10.2 Automatic control and remote control

10.2.1 Main engine

10.2.1.1 Automatic and remote control tests such as remote operation, emergency stop, control position change-over, shut-down, overriding, safe speed reducing etc. are to be carried out according to the requirements of the relevant technical specifications.

10.2.1.2 Key points of quality control:

a) test procedure;
b) test record.

10.2.2 Main generator and switchboard

10.2.2.1 Automatic function test such as safe stop, heavy load paralleling, light load relief, and load sharing, etc. are to be carried out for the electric power station.

10.2.2.2 Key points of quality control:

a) test procedure;
b) setting value;
c) automatic control procedure;
d) test record.

10.2.3 Automatic pump exchanging test

10.2.3.1 Sequential starting on main source failure and automatic pump transferring on low pressure of working medium are to be tested.

10.2.3.2 Key points of quality control:

a) test procedure;
b) automatic control procedure.

10.3 Monitoring and alarming

10.3.1 The monitoring and alarming functions are to be grouped under different systems or types of monitoring parameters, and such groups are to be tested in turn. For the two-state signal sensor, an avometer is to be used to monitor its working conditions so as to ensure the accuracy of the setting value.

10.3.2 Key points of quality control:

a) test procedure;
b) setting of sensor;
c) correct alarming.

10.4 Test of unattended engine room

The unattended engine room test comprises the tests in automatic operation of heavy fuel oil separator, lubricating oil separator, fresh-water generator, bilge separating plant, electric power station and all other relevant automation systems for unattended engine room.

10.4.1 Tests to be performed

10.4.1.1 Main engine remote control test

10.4.1.2 Engine room fire alarm simulation test.

10.4.1.3 Checking for automatic power supply from emergency switchboard at the loss of power from main switchboard when the ship is not running.

10.4.1.4 Test for automatic starting up of stand-by generator at the loss of power from main switch board when the ship is at sea, and sequential starting of pumps when power supply is recovered.

10.4.1.5 System adjustment, elimination of defects and miss alarm when the ship is running at designed speed.

10.4.2 Key points of quality control:

a) test procedure;
b) regulating and marking;
c) test record.

11 MOORING TEST AND SEA TRIAL

The mooring test and sea trial are to be carried out in accordance with the mooring test program and sea trial program respectively approved by both the classification society and ship owner.

11.1 Mooring test and sea trial for hull part

11.1.1 Key points of quality control for inclining test and light-ship measurement:

a) test environment and conditions;
b) over-weight and under-weight;
c) draft, initial heeling and trimming;
d) moving weight and distance;
e) readout accuracy.

11.1.2 Tests for the deck machinery system include the tests for anchoring equipment, mooring equipment, cargo handling equipment, accommodation ladder equipment and water-tight hatch covers.

Key points of quality control:

a) working condition and function of the equipment;
b) accuracy of testing data;
c) operation reliability.

11.1.3 The trial in ship operational performance includes the measuring of speed of

the ship and measuring of inertial stopping distance, turning circle and course stability of the prototype ship.

Key points of quality control:

a) environment conditions such as wind direction, wind speed, sea states and water depth of the trial zone;
b) ballast condition of the ship;
c) propulsion engine output and revolution;
d) rudder angle and ship's course;
e) test and trial procedure and means of data logging.

11.2 Mooring test and sea trial for machinery part

11.2.1 Key points of quality control for the testing of diesel generating set

a) functioning of safety and protection system;
b) deviation of explosion pressure and exhaust temperature of each cylinder;
c) sensitivity and stability of governor;
d) crank web deflection.

11.2.2 The tests of main propulsion system includes those of the safeguard system, monitoring and controlling system, engine starting and reversing, minimum steady speed, remote astern manoeuvring, emergency manoeuvring, operation of super-charger, and measuring of shaft vibration (for prototype ship only).

Key points of quality control:

a) tightness of fastening;
b) monitoring and protection system for alarming, interlocking and shutdown;
c) remote control and reversing manoeuvring system;
d) temperature and lubrication of intermediate bearing;
e) temperature, lubrication and sealing of stern bearing;
f) ventilation of engine room;
g) explosion pressure of cylinder, exhaust temperature and output power of main engine;
h) working parameters of various systems;
i) crank web deflection.

11.2.3 Key points of quality control for function test of boiler system

a) automatic monitoring and controlling system for boiler ignition, combustion and water level;
b) opening and closing of safety valve;
c) stability of accumulated pressure.

11.2.4 Key points of quality control for functional test of the fire alarming system, bilge system, ballast system and fuel oil system:

a) functioning of equipment of each system;
b) working parameters.

11.2.5 The tests of special systems for the oil tanker includes those of pumping system, stripping pumping, remote monitoring of cargo tank level, remote control of valve, inert gas system, tank washing system, portable hydraulic ventilator, oil water discharge monitoring system, etc.

Key points of quality control:

a) working correctness of automatic control, remote control and remote monitoring system;
b) oily water discharging;
c) fire protection and explosion prevention.

11.3 Mooring test and sea trial for electric part

11.3.1 Key points of quality control for the testing of main switchboards and generator sets:

a) regulation of voltage characteristics of the generator;
b) regulation of load characteristics of the diesel engine;
c) test procedure;
d) setting of protection devices.

11.3.2 Key points of quality control for the testing of emergency switchboard and generator set:

a) setting of protection devices;
b) setting of automatic starting device.

11.3.3 Key points of quality control for the testing of electric motors and controllers:

a) overload protection of electric motor;
b) working conditions.

11.3.4 Key points of quality control for the testing of communication and navigation equipment:

a) check of power supply;
b) functioning of the equipment;

11.3.5 Key points of quality control for the testing of transformers and lighting equipment:

a) insulation of circuit;
b) arrangement of lighting fixtures.

12 COMPLETION AND EDLIVERY

12.1 Delivery of cabin equipment, spares and supplies

Following items are to be delivered: cabin facilities, fire-fighting equipment, life-saving appliance, radio communication and navigational aids, spares and other supplies.

12.2 Inspection of marking and operation instructions

Inspection is to be done in accordance with the relevant rules and conventions on the correct fixing and assignment of loadline markings, deadweight markings, fire-fighting indications and safety indications. Inspection is also to be done to confirm that life-saving arrangement plans and operation instructions are displayed correctly at all required locations.

12.3 As-built drawings and ship delivery documents

12.3.1 As-built drawings and documents specified in the ship-building contract.

12.3.2 Records of important testing and inspections made during construction and trial.

12.4 Certificates to be handed over

12.4.1 Class certificates and statutory inspection certificates specified in the shipbuilding contract.

12.4.2 Equipment certificates, navigation certificates and corresponding quality certificates specified in the shipbuilding contract.

12.4.3 Ship delivery and acceptance document.

PART 2

PLANS FOR APPROVAL AND INSPECTIONS AND TESTS FOR ACCEPTANCE

1 PLANS FOR APPROVAL

1.1 General

1.1.1 The plans and documents listed in this standard are the major items that shall be submitted to the classification society and ship owner for review and approval, and are subject to proper adjustment as the case may require for ships of different types, designed for different navigation zones or areas and flying different flags.

1.1.2 The plans and documents may be submitted by stages and batches.

1.1.3 For ensuring that the ship design and construction could be completed in time, the ship owner shall review and return the plans and documents duly approved according to the time schedule and requirement set forth in the shipbuilding contract.

1.2 Plans and documents to be submitted for review and approval

The plans and documents to be submitted for review and approval are divided into four categories according to their professions (see table 2-1-1 through table 2-1-4) as: a) General, hull construction and painting; b) Hull outfitting; c) Machinery installation, and d) Electric installation. In the following tables, the items marked with symbol "✓" are the items that are to be reviewed and approval, and that with the symbol "△" means the items for reference.

Table 2-1-1 General, hull construction and painting

No.	Items	For classification society	For ship owner
1	Technical specifications (including hull, machinery and electric parts)	△	
2	General arrangement	△	✓
3	Lines plan and offsets table	△	△
4	Hydrostatic curves		△
5	Loading condition and stability Calculation	✓	✓
6	Damage stability calculation	✓	✓
7	Freeboard calculation	✓	✓
8	Tonnage calculation		△
9	Speed and power estimation		△
10	Propeller calculation	✓	
11	Capacity plan for tanks and holds	✓	△
12	Tank sounding table		△
13	Propeller plan		✓
14	Fire zone division plan	✓	△
15	Inclining test report	✓	△

16	Lightship weight measurement report		✓
17	Arrangement plan of marks of loadline, draft and bulbous bow	✓	✓
18	Fire control plan	✓	✓
19	Longitudinal strength calculation	✓	
20	Midship section	✓	✓
21	Main structure plan	✓	✓
22	Shell expansion	✓	✓
23	Longitudinal and transverse bulkhead	✓	✓
24	Bow structure	✓	✓
25	Stern structure	✓	✓
26	Cargo space structure	✓	△
27	Engine room structure	✓	✓
28	Superstructure	✓	✓
29	Stem plan	✓	✓
30	Stern frame plan	✓	✓
31	Crane post and foundation structure	✓	✓
32	Tightness test diagram of the ship	✓	✓
33	Mooring test program	✓	✓
34	Sea trial program	✓	✓
35	Painting and coating specification		✓

Table 2-1-2 Hull outfitting

No.	Items	For classification society	For ship owner
1	Inventory of hull outfitting, spares and accessories		✓
2	Equipment number calculation	✓	
3	Arrangement of anchoring equipment	✓	✓
4	Outfitting and marks of anchor chains	✓	✓
5	Arrangement of mooring equipment	✓	✓
6	Arrangement of steering equipment	✓	✓
7	Arrangement of cargo gear	✓	✓
8	Arrangement of metal doors, windows and covers of the ship	✓	✓
9	Arrangement of hatch covers	✓	✓
10	Arrangement of rails and ladders of the ship	✓	✓
11	Arrangement of natural ventilation	✓	✓
12	Arrangement of life-saving and fire-fighting appliances on board the ship	✓	✓
13	Arrangement of safety marks		✓
14	Arrangement of cabins		✓
15	Arrangement of deck coverings	✓	✓

16	Arrangement of insulation	✓	✓
17	Arrangement of radar mast and foremast	✓	✓
18	Arrangement of magnetic compass	✓	✓
19	Arrangement of cathodic protection		✓
20	Bilge and ballasting piping system	✓	✓
21	Fire-fighting piping system	✓	✓
22	Air sounding and injection piping system(including coaming)	✓	✓
23	Drainage system diagram	✓	✓
24	Potable water system diagram	△	✓
25	Water supply system diagram	△	✓
26	Arrangement of steering gear room	✓	✓
27	Air conditioning system and schematic diagram	✓	△
28	Arrangement of air conditioning ducts	✓	✓
29	Arrangement of equipment in air conditioning room		✓

Table 2-1-3 Machinery installation

No.	Items	For classification society	For ship owner
1	List of machinery equipment	△	△
2	Estimation (calculation) of machinery equipment	△	
3	Calculation of lateral vibration of shafting	✓	
4	Calculation of longitudinal vibration of shafting	✓	
5	Calculation of shafting alignment	✓	
6	Calculation of torsional vibration of shafting	✓	
7	Calculation of propeller and shaft connection	✓	
8	Engine room arrangement (including workshop, store and funnel)	✓	✓
9	Calculation of deck foam for oil tanker	✓	
10	Emergency fire pump room arrangement and piping system	✓	✓
11	Installation drawing of main engine and reduction gearbox	✓	✓
12	Arrangement of emergency generator room	✓	✓
13	Piping arrangement of emergency generator room	✓	✓
14	Hydraulic (pneumatic) system and arrangement of deck machinery	✓	✓
15	Sea chest arrangement and construction	✓	✓

16	Shafting arrangement (including intermediate and thrust shaft)	✓	✓
17	Tail shaft and stern tube assembly	✓	✓
18	Shafting strength calculation	✓	
19	Layout of propeller shaft and intermediate shaft	✓	✓
20	Fuel oil system	✓	✓
21	Lubrication oil system	✓	✓
22	Stern tube lubrication oil system	✓	✓
23	Sea water cooling system	✓	✓
24	Fresh water cooling system	✓	✓
25	Compressed air piping system	✓	✓
26	Control air piping system	✓	✓
27	Engine room steam piping system	✓	✓
28	Feed water piping system	✓	✓
29	Condensate water piping system	✓	✓
30	Engine room water supply piping system	△	✓
31	Engine room bilge, ballast and fire extinguishing system	✓	✓
32	Engine room venting, sounding and filling piping system	✓	✓
33	Engine room ventilation piping arrangement	✓	✓
34	Exhaust piping system	✓	✓
35	Steam piping for room heating and miscellaneous usage	✓	✓
36	Engine room fresh water generating system	△	✓
37	Calculation of oil tank heating pipeline	✓	✓
38	CO2 fire extinguishing system and CO2 store room arrangement	✓	✓
39	Calculation and operation instruction of CO2 fire extinguishing system	✓	✓
40	Sewage treatment system		✓
41	Remote control device of quick closing valve (including parts)	✓	✓
42	Board side opening arrangement and structure	✓	✓
43	Provision refrigeration room arrangement		✓
44	Provision refrigeration system		✓
45	Cargo pump room arrangement	✓	✓
46	Cargo oil control room arrangement	✓	✓

47	Arrangement of deck foam fire extinguishing system	✓	✓
48	Arrangement of hydraulic pump station for cargo oil and ballast control system	✓	✓
49	Cargo oil and ballast water piping system	✓	✓
50	Control system for cargo oil and ballast water	✓	✓
51	Insert gas venting pipeline for cargo tank	✓	✓
52	Cargo tank heating pipeline	✓	✓
53	Deck steam and condensate pipeline	✓	✓
54	Draft, oil level sounding and oil temperature measuring pipeline	✓	✓
55	Tank washing machine arrangement and tank washing pipeline	✓	✓
56	Insert gas pipeline	✓	✓
57	Deck foam fire extinguishing system	✓	✓
58	Oil and water discharge monitoring pipeline	✓	✓
59	Operation manual for oil and water discharge monitoring pipeline	✓	✓
60	Operation manual for cargo oil tank washing operation	✓	✓
61	Operation manual for cargo oil tank stripping operation	✓	✓

Table 2-1-4 Electrical installation

No.	Items	For classification society	For ship owner
1	List of major electrical equipment	△	△
2	Calculation of alternating current short circuit current	✓	△
3	Electric load calculation	✓	✓
4	Calculation of capacities for storage batteries	✓	△
5	Electric power primary system diagram	✓	✓
6	Electric power secondary system diagram	✓	✓
7	Normal lighting system	✓	✓
8	Emergency lighting system	✓	✓
9	Navigation light and signal light system	✓	✓
10	Radio communication system	✓	✓
11	Interior communication system	✓	✓
12	Navigational aid system	✓	✓
13	Arrangement of fire alarm and general alarm system	✓	✓

14	Single-line diagram of main switchboard	✓	✓
15	Single-line diagram of emergency switchboard	✓	△
16	Electric equipment arrangement	✓	✓
17	Lighting equipment arrangement	✓	✓
18	Interior communication system arrangement	✓	✓
19	Navigational aid equipment arrangement	✓	✓
20	Wheelhouse arrangement	✓	✓
21	Chart room arrangement		✓
22	Radio room arrangement	△	✓
23	Antenna arrangement	△	✓
24	Main cable layout	✓	△
25	Engine room monitoring and alarm system	✓	✓
26	List of spare and fittings for electric installation (including supplies)		✓
27	Dangerous zones division (for oil tanker and chemical tanker)	✓	△
28	Electric system diagram of wheelhouse control console(panel)	✓	✓
29	Electric system diagram of engine control room console	✓	✓
30	Engine control room arrangement	✓	✓
31	Storage battery charging-discharging diagram and outline plan	✓	✓
32	Electric equipment room arrangement	✓	✓
33	Voltage drop calculation	✓	△
34	Audio and visual signaling device arrangement	✓	✓

2 INSPECTION AND TESTS FOR ACCEPTANCE

2.1 General

2.1.1 The inspection and tests listed in this standard are those to be examined and surveyed by the classification society and the ship owner for acceptance, and are subject to proper adjustment as the case may require for ship of different types, designed for different navigation zones and areas and flying different flags.

2.1.2 Generally, the builder shall, according to the construction schedule, notify the supervisor of the ship owner and the surveyor of the classification society to attend the inspection and test in the following procedures:

a) A “Test Notice” shall be forwarded to the supervisor and surveyor one day before the inspection and test. In special case, this “Test Notice” may be sent to the supervisor and surveyor at the commencing of work of the test

day.

b) The builder shall notify the supervisor and surveyor of any temporary postponement of the schedule inspection and test as early as possible.

c) The inspection and test for painting may be proceeded in different procedures.

2.1.3 The supervisor and surveyor shall sign their names to the “Test Notice” after surveyed the test together with their opinion of accepting or not accepting the result of survey so as to let the builder to proceed with the work accordingly.

2.2 Items of inspections and tests

The following inspections and tests are grouped under five parts according to their professions (see table 2-2-1 through table 2-2-5) as hull construction and painting, outfitting, machinery installation, electric installation and automatic and remote control. In the tables, the items marked with symbol “✓” are the tests to be done for acceptance.

PART 3

CONSTRUCTION ACCURACY

1 HULL CONSTRUCTION

1.1 Steel materials

1.1.1 Surface defects of steel plates are to be kept within the limits as defined in table 3-1-1.

Table 3-1-1

Items		Requirements
Pits, Flaking, Scars, Scratches and air bubbles	Defect area ratio(%)	(1) Zone A is in excellent order, with very slight surface defects less than 0.15mm and no repairing is needed (2) Zone B is in good order, with a certain amount of permissible surface defects, and no repairing is needed. Area enclosed by full lines denotes plate with thickness less than 20mm and area enclosed by dotted lines(including straignt line)denotes plates with thickness from 20 to 50mm) (3) Zone C is in disorder and repairing is needed. I.e. there are certain amount of impermissible surface defects that shall be repaired according to the requirement (4) Repairing method for surface defects: For d<0.07t, by grinding (but in no case d⩽3mm) For 0.07t⩽d⩽0.2t,by built-up welding and followed by grinding Where d is depth of defect, mm; t is plate thickness, mm In case the defect depth exceeds 20% plate thickness and Defect area exceeds 2% plate area, this part of plate is to be replaced as required

1.1.2 The negative thickness tolerance for steel plates of hull structure is to be in compliance with the requirement as defined in table 3-1-2.

Table 3-1-2 mm

Item			Requirement
Negative thickness tolerance for steel plates of hull structure	Thickness of steel plate	>4-5.8	⩽0.3
		>5.5-7.5	⩽0.4
		>7.5-13	⩽0.7
		>13-25	⩽0.8
		>25-30	⩽0.9
		>30-40	⩽1.1

1.1.3 Lamination of steel plate is to be treated according to table 3-1-3.

Table 3-1-3

Item		Requirements
Local lamination		(1) in case the range of lamination is fairly small, it can be chipped out and built-up by welding as shown in fig.(a). in case the range of lamination is fairly small and near the plate surface it is preferable to do the built-up welding as shown in fig.(b) (2) in case the lamination is severe and defective. It must be carefully examined and repaired by appropriate method (3) in case the built-up welding length exceeds 20% the edge length of the steel plate, non-destructive inspection is to be done to check the quality
Severe lamination	—	(1) it is recommended to change part of the plate in case the lamination is fairly extensive (2) minimum breadth or length of the part of standard size plate to be replaced are: for shell plate or strength deck plate: within 0.6 L amidship: 1600mm Outside 0.6 L amidship: 800mm For other members: 300mm or 10 times plate thickness, whichever greater In individual cases, the above values may be reduced to 50mm+4t; where t is plate thickness in mm (3) The whole plate must be replaced in case the lamination is extremely severe and extensive

1.1.4 Defects of casting steel surface are to be treated according to table 3-1-4.

Table 3-1-4

Items	Remarks
In case the depth of defect is over 20% plate thickness or the defect is over 25mm in depth and 150mm in length	Repairing and building up by appropriate method after non-destructive inspection
Air bubbles, flaws and other hazardous defects	

1.2 Marking

1.2.1 Position deviation of the marking is to be kept within the limits as defined in table 3-1-5.

Table 3-1-5 mm

Items	Standard range	Allowable limits	Remarks
Centerline, theoretical line, alignment line, check line and installation position line	2.0	3.0	

1.2.2 Deviation of marking dimensions of parts and members shall be kept within the limits as defined in table 3-1-6.

Table 3-1-6 mm

Items		Standard range	Allowable limits	Remarks
Length		± 2.0	± 3.0	
Breadth		± 1.5	± 2.5	
Difference between diagonals		± 2.0	± 3.0	For rectangular plate
Curved configuration		± 1.5	± 2.5	
straightness	∫ ⩽ 4m	⩽ 1.0	⩽ 1.2	For straight edges of part or member
	4m< ∫ ⩽ 4m	⩽ 1.2	⩽ 1.5	
	∫ ⩽ 8m	⩽ 2.0	⩽ 2.5	
Angle		± 1.5	± 2.0	For every meter
Cut out, opening		⩽ 1.5	⩽ 2.0	

1.2.3 Deviation of marking dimension of block structure is to be kept within the limits as defined in table 3-1-7.

Table 3-1-7 mm

Items	Standard range	Allowable limits	Remarks
Deviation of marking line of panel block, compared with designed dimensions	± 2.5	± 3.5	
Deviation of marking line of member on block, compared with designed position	± 2.5	± 3.5	

1.3 Cutting

1.3.1 Gas cutting

1.3.1.1 Surface roughness of gas cutting is to be kept within the limits as defined in table 3-1-8.

Table 3-1-8 mm

Items			Standard range	Allowable limits	Remarks
Free edges of members	Important members	Automatic semiautomatic cutting	0.10	0.20	(1)for steel sections, tolerance of mechanical cutting is the same as those for manual cutting (2)burrs on free edge shall be remcied
	Others	Manual cutting	0.15	0.30	
		Automatic semiautomatic cutting	0.10	0.20	
		Manual cutting	0.50	1.00	
Vertical grooves	Important members	Automatic semiautomatic cutting	0.10	0.20	
		Manual cutting	0.40	0.80	
	Others	Automatic semiautomatic cutting	0.10	0.20	
		Manual cutting	0.80	1.50	

1.3.1.2 Notches of gas cutting are to be kept within the limits as defined in table 3-1-9.

Table 3-1-9 mm

Items		Standard range	Allowable limits	Remarks
Free edges of members	Upper edge of sheer strake, strength deck, and free edge of opening on shell plate within 0.6Lamidship;extremely important longitudinals and cantilever beams	--	No notch	(1)"Notch" is defined as groove 3 times of the surface roughness (2)Repairing method: ①Finishing by grinding ②Bead welding may be applied where required, but short bead is to be carefully avoided
	Important longitudinals and transverses	--	<1.0	
	Others	--	<3.0	

Table 3-1-9(end) mm

Items			Standard range	Allowable limits	Remarks
Weld edge	Butt weld	Shell plate and strength deck within area of 0.6L amidship	--	<2.0	Notch is to be repaired by grinding or built-up welding. L is ship length
		Others	--	<3.0	
	Fillet weld		--	<3.0	

1.3.1.3 Deviation of gas cutting dimension is to be kept within the limits as defined in table 3-1-10

Table 3-1-10 mm

Items			Standard range	Allowable limits	Remarks
Straightness of plate edge	Automatic welding seam		⩽0.4	⩽0.5	
	Semi-automatic and manual welding seam		⩽1.5	⩽2.5	
Dimension of groove	Angle of groove, θ		$\pm 2^0$	$\pm 4^0$	
	Length of taper, ∫		± 0.5d	± 1.0d	
	Depth of groove,d		± 1.5	± 2.0	
Size of member	Primary members		± 2.5	± 4.0	For example: for members with high accuracy demand such as floors and girders, etc. In double bottom
	Secondary members		± 3.5	± 5.0	
	Breadth of face bar		± 2.0	+4.0 -3.0	

1.3.2 Deviation of shearing dimension is to be kept within the limited as defined in table 3-1-11.

Table 3-1-11 mm

Items	Standard range	Allowable limits	Remarks
Length of member	± 3.0	± 4.0	
Breadth of member	± 2.0	± 3.0	
Breadth of face bar, height of floor	± 2.0	± 3.0	
Straightness of the edge	⩽1.0	⩽1.5	
Curved edge	⩽1.5	⩽2.0	

1.3.3 Deviation of planed and milled edges is to be kept within the limits as defined in table 3-1-12.

Table 3-1-12 mm

Items	Standard range	Allowable limits	Remarks
Straightness of the edge	⩽0.5	⩽1.0	Per 10 m in length
Angle of groove	$\pm 2^0$	$\pm 3^0$	

1.4 Forming

1.4.1 Deviation of flanging is to be kept within the limits as defined in table 3-1-13.

Table 3-1-13 mm

Items			Standard range	Allowable limits	Remarks
Breadth of flange, h			± 3.0	± 5.0	
Depth of web, h		Primary members	± 2.0	± 3.0	
		Secondary members	± 3.0	± 5.0	
Angle of flange, θ			± 2.5	± 4.5	Per 100 in breadth
Straightness in the plane of flange			⩽10	⩽25	Per 10 m
Straightness in the plane of web			⩽10	⩽25	

1.4.2 Deviation of channelled plate is to be kept within the limits as defined in table 3-1-14.

Table 3-1-14 mm

Items		Standard range	Allowable limits	Remarks
Depth of channel, h		± 3.0	± 6.0	
Breadth of channel, b_1、b_2		± 3.0	± 6.0	

1.4.3 Deviation of corrugated plate is to be kept within the limits as defined in table 3-1-15.

Table 3-1-15 mm

Items			Standard range	Allowable limits	Remarks
Depth of corrugation, h			± 2.5	± 5.0	
Pitch of corrugation, d		Connected	± 2.0	± 3.0	
		Not connected	± 6.0	± 9.0	

1.4.4 Bending deviation of angles and built-up profiles is to be kept within the limits as defined in table 3-1-16.

Table 3-1-16 mm

Items		Standard range	Allowable limits	Remarks
Angles	Angle ,	± 1.5	± 2.0	H per 100
	Local bending	± 1.0	± 1.5	Per 1 m in length. Compared with template
Built-up profiles	Bending	± 2.0	± 4.0	Per 10 m in length. Compared with template
	Inclination of face plate	± 1.5	± 3.0	b per 100

1.4.5 Bending deviation of shell plate is to be kept within the limits as defined in table 3-1-17.

Table 3-1-17 mm

Items		Standard range	Allowable limits	Remarks
Plate with single curvature	Gap between curved plate and template	⩽2.5	⩽5.0	Within each frame spacing
	Straightness of check line on triangular template	⩽2.5	⩽5.0	
Plate with double curvature	Deviation between drawn line and reference line on template	± 2.0	± 3.0	Within each frame spacing
	Gap between plate and box template in breadthwise direction	⩽4.0	⩽5.0	
	Gap between plate and box template in lengthwise direction	⩽3.0	⩽5.0	

1.4.6 Heating is to be proceeded according to the requirements as defined in table 3-1-18.

Table 3-1-18 mm

Items			Standard range	Allowable limits	Remarks
Maximum heating temperature on surface	High tensile steel C_{eq}>0.38%	Water or air cooling immediately after heating	Under 650^0C	650^0C	Calculation equation for carbon equivalent: C_{eq}=C+Mn/6+Cr+Mo+V/5+Ni-Cu/15
		Air cooling after heating	Under 900^0C	900^0C	
		Air cooling and subsequently water cooling after heating	Air cooling under 900^0C, water cooling started when temperature below 500^0C	900^0C (air-cooled) 500^0C (water-cooled)	
	High tensile steel C_{eq} ⩽ 0.38% AH~DH	Water or air cooling immediately after heating	Under 1000^0C	1000^0C	
	High tensile steel C_{eq} ⩽ 0.38% EH	Water or air cooling immediately after heating	Under 900^0C	900^0C	

1.5 Fixing and assembling

1.5.1 Fixing and assembling of various welding joints

1.5.1.1 Position deviation of fillet welding joints is to be kept within the limits as defined in table 3-1-19.

Table 3-1-19 mm

Items			Standard range	Allowable limits	Remarks
Alignment of cross joint	a is misalignment t is thickness of thinner plate	Primary structure(longitudinal-stressed members)	⩽ t/4	⩽t/3	(1)when t/3<a ⩽ t/2, leg length is to be increased as shoin in the figure (2)when a >t/2, joint shall be refixed
		Others(stressed members)	⩽ t/3	⩽ t/2	Deviation exceeding allowable values is to be modified accordingly

Table 3-1-19(continued) mm

Items		Standard range	Allowable limits	Remarks
Gap before fillet welding		⩽ 2	⩽ 3	Treatment for exceeding allowable limits: (1)when 3<a ⩽ 5, leg length shall be increased by (a-2) (2)when 5<a ⩽ 16, ① add liner or do built-up welding, if liner is removed, back-up welding must be adopted

Table 3-1-19(end) mm

Items		Standard range	Allowable limits	Remarks
Gap before fillet welding		⩽2	⩽3	②add pad plate and do welding. The pad thickness t_3 shall be $t_1 \leqslant t_3 \leqslant t_2$ (3)when a>16, renew the plate, with cutting height ⩾ 300mm

1.5.1.2 Deviation of lapping gap is to be kept within the limits as defined in table 3-1-20.

Table 3-1-20 mm

Items	Standard range	Allowable limits	Remarks
	⩽2	⩽3	Treatment for exceeding allowable limit: (1)when 3<a⩽5, lge length is to be increased by (a-3) (2)when a>5, fixing is required

1.5.1.3 Deviation of butt welding joints is to be kept within the limits as defined in table 3-1-21.

Table 3-1-21 mm

Items			Standard range	Allowable limits	Remarks
Misalignment		Primary members	⩽ 0.1t, and ⩽3	⩽ 0.15t, and ⩽3	Those exceeding allowable limit are to be refixed a is misalignment t is thickness of smaller plate
		Secondary members	⩽ 015r, and ⩽3	⩽02.t, and ⩽3	Those exceeding allowable limit are to be flattened by adding technological plates
Flatness			⩽2.0	⩽3.0	

Table 3-1-21(continued) mm

Items		Standard range	Allowable limits	Remarks
Gap between roots by manual welding		2~3.5	⩽5.0	Treatment for exceeding allowable limit: (1) when 5<a⩽16 (a)add backing material and weld the front (b)remove backing material and finish back weld

Table 3-1-21(end) mm

Items		Standard range	Allowable limits	Remarks
Gap between roots by manual welding		2~3.5	⩽5.0	(2) when 16<a⩽25 (a)add backing material. Weld main seam only after one slope of the front is in correct form dimension (b)remove backing material and finish back weld (3)when a>25, renew the pate partially and refit

1.5.1.4 Distance between welds is to be in accordance with the limits as defined in table 3-1-22.

Table 3-1-22 mm

Items		Standard range	Allowable limits	Remarks
Between butt welds		--	⩾30	In case the details of construction are not defined in the approved plans, they shall be decided by mould lofting or in shop drawings, they are to be decided within the limits as given in the sketch shown left
		--	⩾0	

Table 3-1-22(end) mm

Items			Standard range	Allowable limits	Remarks
Between butt weld and fillet weld		Primary members	--	⩾10	
		Secondary members	--	⩾0	
		Primary members	--	⩾5.0	
		Secondary members	--	⩾0	

1.5.2 Sub-assembling

1.5.2.1 Accuracy of installation dimensions for flat and curved sub-assemblies is to be in compliance with the requirements as defined in table 3-1-23.

Table 3-1-23 mm

Items		Standard range	Allowable limits	Remarks
Breadth of sub-assembly	Flat	± 4	± 6	
	Curved		± 8	
Length of sub-assembly	Flat	± 4	± 6	
	Curved		± 8	
Squareness of sub-assembly	Flat	4	8	Diagonals of final marking
	Curved	10	15	
Distortion of sub-assembly		10	20	Measured on face plates of beam or girder

1.5.2.2 Accuracy of installation dimensions of block assemblies is to be in

compliance with the requirements as defined in table 3-1-24.

Table 3-1-24 mm

Items		Standard range	Allowable limits	Remarks
Centerlines of upper and lower planes	Flat block	⩽ 5	⩽ 10	
	Curved block	⩽ 7	⩽ 15	
Frame lines of upper and lower planes	Flat block	⩽ 5	⩽ 10	
	Curved block	⩽ 7	⩽ 15	
Twist of assembly(for large rigid block assembly)	Flat block	10	20	Method of measuring: take three points of the main plane to form a plane and measure the deviation of another point against this plane
	Curved block	15	25	
Height of members at same level		± 4	± 6	
Height of member at two different levels		± 5	± 10	
Others, same as for plane and curve d sub-assemblies in table 3-1-23		--	--	

1.5.2.3 Accuracy of installation dimensions of block assemblies of stern frame is to be in compliance with the requirements as defined in table 3-1-25.

Table 3-1-25 mm

Items		Standard range	Allowable limits	Remarks
Distance between upper and lower carriers, a		± 5	± 10	
Distance between aft edge of boss and aft peak bulkhead, b		5	10	
Inclination of sub-assembly, c				
Deviation of rudder post centerline from shaft centerline, d		⩽ 4	⩽ 8	
Others, same as for those in table 3-1-24		--	--	

1.5.2.4 Accuracy of installation dimensions of assemblies including main engine foundation is to be in compliance with the requirements as defined in table 3-1-26.

Table 3-1-26 mm

Items	Standard range	Allowable limits	Remarks
Flatness of face plate of main engine foundation	⩽5	⩽10	
Length and breadth of face plate of main engine foundation	± 4	± 6	If the foundation is of longitudinal girder construction, measure the deviation from the centerline
Others, same as for those in table 3-1-24	--	--	

1.5.3 Assembling on shipway

Assembling deviation on the shipway is to be kept within the limits as defined in table 3-1-27.

Table 3-1-27 mm

Items		Standard range	Allowable limits	Remarks
centerlines	Double bottom sub-assembly and shipway	⩽3.0	⩽5.0	
	Deck, platform, transverws bulkhead and double bottom	⩽5.0	⩽8.0	
	Fore/aft terminal points and shipway	<0.1%h	<0.15%h	h is height of fore/aft terminal points
	Superstructure and deck	⩽4.0	⩽8.0	
	Centerlines of upper rudder carrier and shipway	⩽4.0	⩽8.0	
	Center of stern shaft hole and centerline of shipway	⩽5.0	⩽8.0	

Table 3-1-27(end) mm

Items		Standard range	Allowable limits	Remarks
Levelness	Levelness of four corners of bottom platform and deck	± 8.0	± 12.0	
	Levelness of bulkhead(port/starboard, fore/aft)	± 4.0	± 6.0	
	Levelness of side sub-assembly(fore/aft)	± 5.0	± 10.0	
	Levelness at four corners of superstructure	± 10.0	± 15.0	
Height positioning	Bulkhead	± 3.0	± 6.0	
	Side sub-assembly	± 5.0	± 8.0	
	superstructure	± 10.0	± 15.0	
Frame spacing at sub-assembly joint		± 10.0	± 20.0	
Perpendicularity of bulkhead		<0.1%h and<10.0	<0.12%h and<12.0	h is height of bulk-head

1.6 Welding

1.6.1 Deviation of welding dimensions is to be kept within the limits as defined in table 3-1-28.

Table 3-1-28 mm

Items		Standard range	Allowable limits	Remarks
Height of bead, h		⩽0.2B	⩽6.0	B is breadth of bead
Flank angle, θ		$\leqslant 60^0$	$<90^0$	

1.6.2 The requirements for weld under-cuts are defined in table 3-1-29.

Table 3-1-29 mm

Items		Standard range	Allowable limits	Remarks
Butt weld	Primary members	--	e ⩽ 0.5	(1)e is between 0.5 to 0.8 the sharp cutting edge is to be repaired even if angle of undercut is larger than 90^0 (2)the sharp configuration of fillet weld is to be repaired
	Secondary members	--	e ⩽ 0.8	
Fillet weld		--	e ⩽ 0.8	

1.6.3 Deviation of dimensions of fillet welds is to be kept within the limits as defined in table 3-1-30.

Table 3-1-30 mm

Items	Standard range	Allowable limits	Remarks
Specified dimension of welding, K actual dimension of welding. K_a specified throat depth. h actual throat depth. h_a	--	$K_a \geqslant 0.9K$ $h_a \geqslant 0.9h$	In case it is not within allowable limits. Weld-up over it with the electrodes is required

1.6.4 Requirements for short bead, tack welding bead and repairing bead are as defined in table 3-1-31.

Table 3-1-31 mm

Items	Standard range	Allowable limits	Remarks
500Mpa high tensile steel	--	⩾ 50	In case bead length is less allowable limits. Preheating 10025C is necessary
Grade E mild steel	--	⩾ 30	

1.6.5 Arc-strike is to be in compliance with the requirements as defined in table 3-1-32.

Table 3-1-32 mm

Items	Standard range	Allowable limits	Remarks
500MPa high tensile steel. Grade E mild steel, cast steel	--	Not allowed	In case are strike was made, do repairing as below: (a)weld over a short bead over 50 mm on the arcstrike (b)remove the hardened zone by grinding

1.6.6 Welding joint distorsion is to be kept within the limits as defined in table 3-1-33.

Table 3-1-33 mm

Items		Standard range	Allowable limits	Remarks
Shell plate between 0.6L amidship, e	E is distorsion of shell plate in frame span	--	⩽6	In case it exceeds allowable limits, it is to be repaired or rewelded after correcting and cutting
Shell plate at fore and aft ends, e		--	⩽7	
Others, e		--	⩽8	

1.7 Fairness and finishing

1.7.1 Fairness

1.7.1.1 Local fairness is to be in compliance with the requirements as defined in table 3-1-34.

Table 3-1-34 mm

Items		Standard range	Allowable limits	Remarks
Shell plate	Parallel midbody(side plate, bottom plate)	⩽4	⩽6	For every frame spacing b is fairness
Double bottom	Fore and aft curved parts	⩽5	⩽7	
	Tank top plate	⩽4	⩽6	
Bulkhead		⩽6	⩽8	

Table 3-1-34(end) mm

Items		Standard range	Allowable limits	Remarks
Upper deck	Parallel midbody(including longitudinal and transverse structure)	⩽4	⩽6	
	Fore and aft parts	⩽6	⩽8	
	Non-exposed part	⩽7	⩽9	
Second deck	Exposed part	⩽6	⩽8	
	Non-exposed part	⩽7	⩽9	
Superstructure deck	Exposed part	⩽4	⩽6	
	Non-exposed part	⩽7	⩽9	
House walls	Exposed part	⩽4	⩽6	
	Both sides of non-exposed part	⩽7	⩽9	

1.7.1.2 Overall fairness is to be in compliance with the requirements as defined in table 3-1-35.

Items		Standard range	Allowable limits	Remarks
Shell plate	Parallel midbody	±2∫/1000	±3∫/1000	Measuring method: Minimun measuring length ∫=3 m but about 5 m for bulkhead and outside wall
	Fore and aft parts	±3∫/1000	±4∫/1000	
Deck, platform and tank top		±3∫/1000	±4∫/1000	
Bulkhead		±4∫/1000	±5∫/1000	
superstructure	Deck	±3∫/1000	±4∫/1000	
	Outside wall	±2∫/1000	±3∫/1000	
Others		±5∫/1000	±6∫/1000	

1.7.1.3 Straightness of inner supporting members is to be in compliance with the requirements as defined in table 3-1-36.

Table 3-1-36 mm

Items	Standard range	Allowable limits	Remarks
Main members, such as strength beam, web frame, floor and deep deck girder	⩽5	⩽8	
Other members, such as longitudinal, frame, beam and stiffener, with length L: L⩾1000 L<1000	⩽10 ⩽5	⩽13 ⩽8	
"H" type pillar between decks	⩽4	⩽6	
Other supports	⩽6	⩽10	

1.7.2 Finishing

1.7.2.1 Staging sockets and lifting eye pieces are to be finished according to the requirements as defined in table 3-1-37.

Table 3-1-37 mm

Items		Requirements	Remarks
Staging sockets	In water and oil tanks	May be retained totally	(1)after cutting off those lifting eye pieces affecting appearance and passage. The surface is to be finished as flush as the base plate (2)such pieces may be removed by gas cutting at other places, root may be retained, but for parts especially important to strength, built-up welding is to be made to smooth and flushing after cutting
	In engine room	Only those affecting appearance and passage is to be removed	
	In cargo hold	Only those at lower level and on hatch coaming is to be removed	
	On exposed part of shell and upper deck, etc.	To be removed totally	
Lifting eye pieces	In water and oil tanks	May be retained provided not effecting passage	
	In cargo hold	10 mm of root may be retained on back side of deck plate	
	On exposed part of shell and upper deck etc.	To be removed totally	Except fixed eye pieces

1.7.2.2 Temporary pieces are to be finished according to the requirements as defined in table 3-1-38.

Table 3-1-38 mm

Items	Requirements	Remarks
Where good oppearance is required	Outside surface of shell plate, deck and superstructure are to be chipped flush and smooth. Under-cut of temporary pieces may have a depth of 0.5mm. above this limit, the cut is to be welded over and grinded flush.	Temporary pieces are not to be fixed or to be kept as less as possible on sheer strakes and on corner plate of strength deck with under-cuts welded over and grinded flush completely
Where good oppearance is not required	Temporary pieces inside holds and similar places are to be chipped off if they are at particularly conspicuous places. Under-cut may have a depth of 0.5~1.0 mm and a length not more than 30mm. Over these limits they are to be welded over and finished. But may be not chipped off and grinded.	

1.7.2.3 Holes made erroneously are to be treated according to the requirements as defined in table 3-1-39.

Table 3-1-39 mm

Items		Allowable limits	Method of treatment
Φ<200	Main strength members on shell plate or upper deck	(1)cut an opening over 75 in diameter, then treat by method A. (2)Cut an opening over 200 in diameter, then treat by method B	A: spigot patch: ∫ =50 a=4~6 t_1=0.5t~1t θ =30^0~40^0
	Others	Cut an opening over 200 in diameter, then treat by method B, C or D	

Table 3-1-39(end) mm

Items		Allowable limits	Method of treatment
$\Phi \geqslant 200$	Main strength members on shell plate or upper deck	Treat by method B	B: repair and weld by insert plate C: built up and repair by lap welding(to same thickness as base plate)
	Others	Treat by method B or C	
Triangular opening, scallop, rectangular opening		Treat by method B or C	D: if it is difficult from structual point of view to cut an opening over 200 in diameter, it may be processed by low hydrogen electrode after preheating and followed by radiographic exmination or ultrasonic inspection

1.7.2.4 Repairing by insert piece is to be done according to the requirements as defined in table 3-1-40.

Table 3-1-40 mm

Items		Allowable limits	Method of treatment
Repairing by insert piece	Minimum length of insert piece, L_{min}	300	(1)seam with insert piece is to be welded first (2)original seam is to be welded over at least for 150 at one end (3)R is 5 times plate thickness, minimum thickness is 100
	Minimum breadth of insert piece, B_{min}	300	
	Minimum roundness of insert piece, R_{min}	5 times plate thickness, but $\geqslant 100$	

Table 3-1-40(end) mm

Items		Allowable limits	Method of treatment
Repairing welding by insert piece for composite unit	Minimum length of insert piece. L_{min}	300	Welding procedure: ① → ② → ③ → ④

1.8 Principal dimensions and deformation

1.8.1 Deviation of principal dimensions is to be kept within the limits as defined in table 3-1-41.

Table 3-1-41 mm

Items	Standard range	Allowable limits	Remarks
Overall length or length between perpendiculars. L	± L/1000	Not specified	
Moulded breadth, B	± B/1000	Not specified	
Moulded depth, D	± D/1000	Not specified	

1.8.2 Deformation of hull form is to be kept within the limits as defined in table 3-1-42.

Table 3-1-42 mm

Items			Standard range	Allowable limits	Remarks
Deflection of keel centerline	Within whole length between fore and aft peak tanks		± 25	± 35	
	Distance between adjacent transverse bulkheads		± 15	± 20	
Warping-up	Cocking-up of bow, h		± 30	± 40	

Table 3-1-42(end) mm

Items			Standard range	Allowable limits	Remarks
Warping-up	Warping-up of stern, h		± 20	± 30	
	Transversely warping-up or sagging-down		± 15(per 10m of breadth)	± 25(per 10m of breadth)	

1.9 Draught and freeboard marks

1.9.1 Deviation of draught mark is to be kept with the limit as defined in table 3-1-43.

Table 3-1-43 mm

Items	Standard range	Allowable limits	Remarks
Deviation in regard to the straight ruler	± 1.0	± 2.0	

1.9.2 Deviation of freeboard mark is to be kept within the limit as defined in table 3-1-44.

Table 3-1-44 mm

Items	Standard range	Allowable limits	Remarks
Deviation in regard to the template	± 1.0	± 1.0	

2 HULL OUTFITTING

2.1 Rudder

2.1.1 The rudder plate and rudder stock are to be manufactured in accordance with the requirements as defined in table 3-2-1.

Table 3-2-1 mm

Items		Standard range	Allowable limits	Remarks
Rudder plate	Deviation of rudder plate height, △L	± 4	--	
	Deviation of rudder plate width, △B	± 4 0	--	

Table 3-2-1(continued) mm

Items		Standard range	Allowable limits	Remarks
Reamer bolt	Roundness of bolt hole	⩽0.01	⩽0.01	
	Cylindricity of bolt hole	⩽0.02	⩽0.02	
	Roundness of bolt	⩽0.01	⩽0.01	
	Cylindricity of bolt	⩽0.02	⩽0.02	
	Oversize of bolt, d-D	0.005~0.015	>0	d is bolt diameter D is bole diameter

Table 3-2-1(continued) mm

Items		Standard range	Allowable limits	Remarks
Connection of rudder plate and rudder stock	Deviation of stock length, $\triangle L_1$	± 3	--	
	Deviation of total length, $\triangle L+\triangle L_1$	± 5	--	
	Offset of centerlines of rudder plate and rudder stock after installation, $\triangle L_2$	⩽0.25	⩽0.50	
	Clearance between stock and rudder plate flange after installation, $\triangle L_3$	⩽0.03	⩽0.50	The allowable inserting depth of 0.05 feeler shall not exceed 15
	Contact area of flange	>60%	--	
Pintle	Contact area between taper part and rudder plate	>60%	>60%	
	Oversize of pintle when fitted with stainless steel sleeve, d_1-d_2	(5~10) d_1/10000	(5~10) d_1/10000	d_1 is outside diameter of pintle d_2 is inside diameter of sleeve
	Oversize of pintle when fitted with bronze sleeve, d_1-d_2	(10~20) d_1/10000	(10~20) d_1/10000	

2.1.2 The rudder is to be installed according to the requirements as defined in table 3-2-2.

Table 3-2-2 mm

Items		Standard range	Allowable limits	Remarks
Gudgeon	Oversize when fitted with stainless steel bush, d_1-d_2	0~0.05	0~0.05	d_1 is outside diameter of bush d_2 is inside diameter of gudgeon
	Oversize when fitted with stainless steel bush, d_1-d_2	0~0.05	0~0.05	
	Oversize when fitted with stainless steel bush, d_1-d_2	0~0.05	0~0.05	
	Oversize when fitted with stainless steel bush, d_1-d_2	0~0.05	0~0.05	

Table 3-2-2(continued) mm

Items		Standard range	Allowable limits	Remarks
Tiller	Oversize with cylindric part of rudder stock	>0	>0	
	Oversize with key	0. 005~ 0.015	>0	
	Contact area with rudder stock taper	>60%	>60%	
Rudder carrier	Contact area between rudder carrier and friction disk	>50%	>50%	
	Clearance between rudder carrier and friction disk, △L	0.05	0.05	

Table 3-2-2(end) mm

Items		Standard range	Allowable limits	Remarks
Centerline of rudder system	Deviation of centerline for rudder carriers, upper and lower gudgeons after boring(in both fore and aft direction and athwartship direction), △L	⩽0.3	⩽0.5	
	Offset of rudder centerline and shafting centerline, △L	⩽4	⩽3	

2.2 Mast, deck crane post and derrick boom

2.2.1 Mast and deck crane post are to be manufactured in accordance with the requirements as defined in table 3-2-3.

Table 3-2-3 mm

Items	Standard range	Allowable limits	Remarks
Deviation of diameter	± D/200 but max.5.0	± D/150 but max.7.5	D is diameter of post
straightness	⩽1L/1000 and ⩽10	⩽1.5L/1000 and ⩽15	L is total length

2.2.2 Derrick boom is to be manufactured in accordance with the requirements as defined in table 3-2-4.

Table 3-2-4 mm

Items		Standard range	Allowable limits	Remarks
Derrick boom	Deviation of length, △L	± 7	± 10	
	Linearity	⩽ 5	⩽ 10	
	Deviation of diameter, △D	± D/100	± 2D/100	
Appendage	Roundness at the installing place of fork head of boom	⩽ 1	⩽ 2	
	Deviation angle between fork head of boom and eyeplate	$\leqslant 1^0$	$\leqslant 2^0$	

2.2.3 Mast and deck crane post are to be installed in accordance with the requirements as defined in table 3-2-5.

Table 3-2-5 mm

Items		Standard range	Allowable limits	Remarks
	Deviation of centerline position of mast and post, $\triangle L_1$	⩽3	⩽5	
	Verticality, $\triangle L_2$	⩽ 1.0H/1000	⩽ 2.0H/1000	
	Deviation of height, $\triangle H$	± 10	--	

2.3 Cargo hold hatch cover

2.3.1 The manufacturing of hatch cover is to be in accordance with the requirements as defined in table 3-2-6.

Table 3-2-6 mm

Items				Standard range	Allowable limits	Remarks
Deviation of dimensions of whole hatch cover and single cover panel	Length of whole cover, L_1, or Length of single panel, L_3, or Breadth of single panel, L_4	>1000~2000	$\triangle L_1$ or $\triangle L_3$ or $\triangle L_4$	± 3	± 4	
		>2000~4000		± 4	± 5	
		>4000~8000		± 5	± 6	
		>8000~12000		± 6	± 7	
		>12000~16000		± 7	± 8	
		>16000~20000		± 8	± 9	
		>20000~24000		± 9	± 10	
		>24000~28000				
		>28000				

Table 3-2-6(continued) mm

Items				Standard range	Allowable limits	Remarks
Planeness of single cover panel(i.e. deformation of the region formed by girders within the panel)	Max .length of the girders of the panel. L_5	⩽5000	F_1	⩽3	⩽5	The measuring shall be done at the supported condition as that on board the ship
		>5000~15000		⩽6	⩽8	
		>15000~25000		⩽10	⩽12	

Table 3-2-6(continued) mm

Items				Standard range	Allowable limits	Remarks
Local deformation of top plate	L_6 (t=7~9)	⩽400	$\triangle L_6$	⩽3	⩽4	In case the measuring distance L_6 between two contact points is larger than the distance L_6 between the stiffeners, the L_6 value shall be adopted
		>400~600		⩽4	⩽5	
		>600~800		⩽5	⩽6	
		>800~1000		⩽6	⩽7	
		>1000~1200		⩽7	⩽8	
	L_6 (t=10~12)	⩽400	$\triangle L_6$	⩽3	⩽3	
		>400~600		⩽3	⩽4	
		>600~800		⩽4	⩽5	
		>800~1000		⩽5	⩽6	
		>1000~1200		⩽6	⩽7	

Table 3-2-6(continued) mm

Items				Standard range	Allowable limits	Remarks
Deviation of dimensions of whole hatch cover and single cover panel	Breadth of whole hatch cover, L_2	>1000~2000	△ L_2	± 3	± 4	
		>2000~4000		± 5	± 6	
		>4000~8000		± 7	± 8	
		>8000~12000		± 9	± 10	
		>12000~16000		± 11	± 12	
		>16000~20000		± 13	± 14	
		>20000~24000		± 15	± 16	
		>24000~28000		± 16	± 17	
		>28000				

Table 3-2-6(continued) mm

Items				Standard range	Allowable limits	Remarks
Deviation of dimensions of whole hatch cover and single cover panel	L_1 or L_2 or L_3 or L_4	>1000~2000	D1-D2 or D3-D4	± 6	± 8	L_1, L_3 or L_2,L_4which ever smaller
		>2000~4000		± 7	± 9	
		>4000~8000		± 8	± 10	
		>8000~12000		± 10	± 12	
		>12000~16000		± 11	± 13	
		>16000~20000		± 12	± 14	
		>20000~24000		± 13	± 15	
		>24000~28000		± 14	± 16	
		>28000				

Table 3-2-6 mm

Items				Standard range	Allowable limits	Remarks
Planeness of single cover panel(i.e. deformation of the region formed by girders within the panel)	Max. length of the girders of the panel, L_5	⩽5000	f_1	⩽3	⩽5	The measuring shall be done at the supported condition as that on board the ship
		>5000~15000		⩽6	⩽8	
		>15000~25000		⩽10	⩽12	

Table 3-2-6(continued) mm

Items				Standard range	Allowable limits	Remarks
Local deformation of top plate	L_6 (t=7~9)	⩽400	△ L_6	⩽3	⩽4	In case the measuring distance L_6 between two contact points is larger than the distance L_9 between the stiffeners, the L_0 value shall be adopted
		>400~600		⩽4	⩽5	
		>600~800		⩽5	⩽6	
		>800~1000		⩽6	⩽7	
		>1000~1200		⩽7	⩽8	
	L_6 (t=10~12)	⩽400	△ L_6	⩽3	⩽3	
		>400~600		⩽3	⩽4	
		>600~800		⩽4	⩽5	
		>800~1000		⩽5	⩽6	
		>1000~1200		⩽6	⩽7	

Table 3-2-6(continued) mm

Items			Standard range	Allowable limits	Remarks
Elevations of adjacent top plates	Conventional hatch cover	$\triangle L_7$	⩽6	⩽7	
		$\triangle L_8$	⩽3	⩽4	
	Hatch cover for carrying evenly-loaded containers and hatch cover for tweendeck of reefer with wooden gratings	$\triangle L_7$	⩽4	⩽5	
		$\triangle L_8$	⩽2	⩽3	
	Hatch cover for tweendeck in paper product cargo hold	$\triangle L_7$	⩽1	⩽2	
		$\triangle L_8$	⩽1	⩽2	
$\triangle L_7$_Elevation of top plates at place supported by girder $\triangle L_8$_ Elevation of top plates without girder supporting					

Table 3-2-6(continued) mm

Items				Standard range	Allowable limits	Remarks
Size deviation of rubber packing slot at periphery	$\triangle L_9$			--	±1	For local measuring: the deviation of levelness shall be kept within 2 mm
	Open type structure, A	⩽3000	F_2	⩽2	⩽3	
			F_3	⩽2	⩽2	
		>3000~7000	F_2	⩽3	⩽4	
			F_3	⩽2	⩽3	
		>7000~25000	F_2	⩽5	⩽6	
			F_3	⩽4	⩽5	

Table 3-2-6(end) mm

Items			Standard range	Allowable limits	Remarks
A-length of slot at side or end	Close type structure	f_4	⩽3	⩽4	

2.3.2 The manufacturing of hatch cover coaming is to be in accordance with the requirements as defined in table 3-2-7.

Table 3-2-7 mm

Items				Standard range	Allowable limits	Remarks
Deviation of dimensions of hatch coaming opening	Length, L_{10}, or breadth, L_{11}	>1000~2000	$\triangle L_{10}$ Or $\triangle L_{11}$	±3	±4	
		>2000~4000		±5	±6	
		>4000~8000		±7	±8	
		>8000~12000		±9	±10	
		>12000~16000		±11	±12	
		>16000~20000		±13	±14	
		>20000~24000		±15	±16	
		>24000~28000		±16	±17	
		>28000		±17	±18	

Table 3-2-7(continued) mm

Items				Standard range	Allowable limits	Remarks
Deviation of dimensions of hatch coaming opening	Length, L_{10}, or breadth, L_{11}	>1000~2000	D_5 ~ D_6	± 6	± 8	
		>2000~4000		± 8	± 10	
		>4000~8000		± 11	± 13	
		>8000~ 12000		± 14	± 16	
		>12000~ 16000		± 17	± 19	
		>16000~ 20000		± 20	± 22	
		>20000~ 24000		± 22	± 24	
		>24000~ 28000		± 24	± 26	
		>28000		± 26	± 28	

Table 3-2-7(continued) mm

Items		Standard range	Allowable limits	Remarks
Straightness of side coaming	$\lvert a2\text{-}a1 \rvert$	⩽ 4	⩽ 5	

Table 3-2-7(end) mm

Items				Standard range	Allowable limits	Remarks
Levelness of face plate of coaming A1-lentgh of compression bar	Compression bar to be fixed late (adjustable)	⩽3000	f_5	⩽2	⩽3	For local measuring: the deviation of levelness shall be kept within 2 mm for every 1 meter length
		>3000~13000		⩽3	⩽4	
		>13000~28000		⩽4	⩽5	
	Compression bar to be fixed before hand(welded), A1	⩽7000		⩽2	⩽2	
		⩽28000		⩽2	⩽3	
	Without compression bar(sliding rubber)	⩽14000		⩽2	⩽3	
		⩽28000		⩽3	⩽4	

2-3-3 The installation of sealing rubber is to be in accordance with the requirements as defined in table 3-2-8.

Table 3-2-8 mm

Items				Standard range	Allowable limits	remarks
Deviation of compression of rubber and center of compression bar	Regutangular rubber with foamed core	Size32x71 L_{12} = 8	ΔB	⩽6	⩽7	The normal rubber compression is one-fourth of rubber thickness
			ΔL_{12}	±1	±2	
		Size 40x71 L_{12} = 10	ΔB	⩽6	⩽7	
			ΔL_{12}	±2	±3	
Δ B--Center deviation of rubber as against compression bar L_{12}--Compression of rudder Δ L_{12} --Deviation of compression	Regutangular rubber with foamed core	Size50x93 L_{12} = 13	ΔB	⩽8	⩽9	
			ΔL_{12}	±2	±3	
		Size 50x120 L_{12} = 13	ΔB	⩽11	⩽12	
			ΔL_{12}	±2	±3	

Table 3-2-8 (continued) mm

Items				Standard range	Allowable limits	remarks
ΔL_{13}—Compression of rudder ΔL_{13}—Deviation of compression	Sliding rudder	Hollow67x72 L_{13} = 12	ΔL_{13}	± 6	± 8	
		Hollow60x98 L_{13} = 11	ΔL_{13}	± 5	± 7	
		Hollow57x72 L_{13} = 7	ΔL_{13}	± 2	± 3	

(END)

2.3.4 The installation of container sockets on hatchcover is to be in accordance with the requirement as defined in table 3-2-9.

Table 3-2-9 mm

Items				Standard range	Allowable limits	remarks
Position deviation of container socket on hatchcover	**Standard container**	40ft L=11985	ΔL	± 3.0	± 4.5	
			D_7–D_8	± 5.0	± 7.0	
		30ft L = 8918	ΔL	± 3.0	± 4.5	
			D_7–D_8	± 6.0	± 10.0	
		20ft L = 5853	ΔL	± 4.0	± 6. 0	
			D_7–D_8	± 7.0	± 13.0	
	Non-standard container	49ft L = 14731	ΔL	± 3.0	± 4. 5	
			D_7–D_8	± 5	± 7.0	
		45ft L = 13513	ΔL	± 3.0	± 4. 5	
			D_7–D_8	± 5.0	± 7.0	
		24.5ft L = 7225	ΔL	± 3.0	± 4.5	
			D_7–D_8	± 6.0	± 10.0	

Table 3-2-9(continued) mm

Items							Standard range	Allowable limits	Remarks
Position deviation of container socket on hatchcover	e_1-e_2						---	⩽5/1000	
Planeness of common region formed by container sockets	Common region formed by 4 sockets of a single container					f_6	⩽4	⩽7	
	Common region formed by 8 sockets of 20ft and 40ft containers	Center spacing A	203	Spacing between containers S	25	f_7	⩽4	⩽7	
							⩽4	⩽7	
							⩽6	⩽10	
							⩽6	⩽10	

(END)

2.4 Weathertight closing devices

2.4.1 The manufacture and installation of weathetight door is to be in accordance with the requirements as defined in table 3-2-10.

Table 3-2-10 mm

Items		Standard range	Allowable limits	Remarks
Door plate	Deviation of breadth, ΔL_1	± 2	± 4	
	Deviation of height, ΔL_2	± 2	± 4	
	Difference between lenghts of diagonals, D_1–D_2	± 2	± 4	
	Degree of distortion	⩽2	⩽4	Degree of distortion is between middle points of two diagonals
	Straightness, ΔL_3	⩽1	⩽3	
	Planeness, ΔL_4	⩽1	⩽3	

Table 3-2-10(continued) mm

Items		Standard range	Allowable limits	Remarks
Door frame	Deviation of breadth, ΔL_1	± 2	± 4	
	Deviation of height, ΔL_2	± 2	± 4	
	Difference between lenghts of diagonals, $D_1–D_2$	± 2	± 4	
	Degree of distortion	⩽ 2	⩽ 4	Degree of distortion is between middle points of two diagonals
	Straightness, ΔL_3	⩽ 1	⩽ 3	
	Planeness, ΔL_4	⩽ 1	⩽ 3	
Wall opening	Deviation of height, ΔL_1	± 4	± 6	
	Deviation of breadth, ΔL_2	± 4	± 6	
	Difference between lenghts of diagonals, $D_1–D_2$	± 2	± 4	
	Deviation of sill height(lowest point), ΔL_3	+15 0	+30 -10	
	Planeness of wall at opening, ΔL_4	⩽ 2	⩽ 3	
Installation of door	Deviation of sill height	+15 0	+30 0	
	Verticality of door center	⩽ 2L/1000	⩽ 2L/1000	L is distant of seal center of door
	Deviation of distant of seal to door center, ΔL	± 2	± 2	

(END)

2.4.2 the manufacture and installation of fire-proof door is to be in accordance with the requirement as defined in table 3-2-11.

Table 3-2-11 mm

Items		Standard range	Allowable limits	Remarks
Door	Deviation of breadth, ΔL_1	± 1.0	± 1. 0	
	Deviation of height, ΔL_2	± 1.0	± 1.0	
	Deviation of thickness, ΔL_3	± 1.0	± 1.0	
	Difference between lengths of diagonals, $D_1–D_2$	± 2	± 4	
	Degree of distortion	⩽2.0	⩽2.0	Degree of distortion is between middle points of two diagonals
	Straightness, ΔL_4	⩽1.0	⩽1.0	
	Planeness, ΔL_5	⩽1.0	⩽2.5	
Door frame	Deviation of breadth, ΔL_1	± 1.0	± 1.0	
	Deviation of height, ΔL_2	± 1.0	± 1.0	
	Deviation of depth, ΔL_3	± 2.0	± 2.0	
	Difference between lengths of diagonals, $D_1–D_2$	± 2.0	± 4.0	
	Degree of distortion	⩽2.0	⩽2.0	Degree of distortion is between middle points of two diagonals
	Straightness, ΔL_4	〈1.0	〈1.0	

Table 3-2-11(continued) mm

Items		Standard range	Allowable limits	Remarks
Wall opening	Deviation of height, ΔL_1	± 2.0	± 2.0	
	Deviation of breadth, ΔL_2	± 2.0	± 2.0	
	Difference between lengths of diagonals, $D_1–D_2$	± 2.0	± 4.0	
	Deviation of sill height(lowest point), ΔL_3	$^{+10}_{0}$	----	
	Deformation of wall at cut, ΔL_4	$\leqslant 2.0$	$\leqslant 2.0$	
Installation of door	Clearance between door frame and door, ΔL_1	± 1.0	± 1.0	
	Planeness of door frame and door	$\leqslant 1.0$	$\leqslant 1.0$	
	Deviation of hinge position, ΔL_2	± 5.0	± 5.0	

(END)

2.4.3 The manufacture and installation of weathertight small hatchcover is to be in accordance with the requirement as defined in table 3-2-12.

Table 3-2-12 mm

Items		Standard range	Allowable limits	Remarks
Hatch cover	Deviation of breadth, ΔL_1	± 3	± 5	
	Deviation of height, ΔL_2	± 3	± 5	
	Difference between lengths of diagonals, $D_1–D_2$	± 2	± 4	
	Degree of distortion	⩽ 2	⩽ 3	Degree of distortion is between middle points of two diagonals
	Straightness, ΔL_3	⩽ 1	⩽ 2	
	Planeness, ΔL_4	⩽ 1	⩽ 3	
Hatch coaming	Deviation of length, ΔL_1	± 2	± 5	
	Deviation of breadth, ΔL_2	± 2	± 5	
	Difference between lengths of diagonals, $D_1–D_2$	± 2	± 4	
	Deviation of height(lowest point), ΔL_3	+6 0	+20 0	
	Degree of distortion	⩽ 2	⩽ 3	Degree of distortion between middle points of two diagonals
	Straightness, ΔL_4	⩽ 1	⩽ 3	
	Planeness, ΔL_5	⩽ 1	⩽ 3	

Table 3-2-12(continued) mm

Items			Standard range	Allowable limits	Remarks
Hatch cover	**Deviation of breadth, ΔL_1**	**Penetration type**	± 2	± 3	
		non-penetration type	+2 -3	+3 -5	
	Deviation of height, ΔL_2	**Penetration type**	± 2	± 3	
		non-penetration type	+2 -3	+3 -5	
	Difference between lengths of diagonals, $\mathbf{D_1–D_2}$		± 2	± 4	
Watertight structure	Touch between gasket and coaming		B ⩾ t/2	B ⩾ t/2	B is breadth of compression print

(END)

2.4.4 The manufacture and installation of circular weathertight hatch cover is to be in accordance with the requirement as defined in table 3-2-13.

Table 3-2-13 mm

Items		Standard range	Allowable limits	Remarks
Cover	Deviation of diameter, ΔD	± 3	± 5	
	Roundness	⩽ 2	⩽ 3	
	Planeness, ΔL	⩽ 1	⩽ 3	
Watertight structure	Touch between gasket and coaming	B ⩾ t/2	B ⩾ t/2	B is breadth of compression print

Table 3-2-12(continued) mm

Items			Standard range	Allowable limits	Remarks
Deck plate opening	**Deviation of breadth, ΔL_1**	Penetration type	± 2	± 3	
		Non-penetration type	+2 -3	+3 -5	
	Deviation of height, ΔL_2	Penetration type	± 2	± 3	
		Non-penetration type	+2 -3	+3 -5	
	Difference between lengths of diagonals, $\mathbf{D_1–D_2}$		± 2	± 4	

(END)

2.4.5 The installation of rectangular window is to be in accordance with requirements of table 3-2-14.

Table 3-2-14 mm

Items		Standard range	Allowable limits	Remarks
	Planeness of wall at cut, ΔL_1	⩽ 2	⩽ 3	
	Clearance between window frame and cut, ΔL_2	⩽ 1	⩽ 2	

(END)

2.4.6 the installation of side scuttle is to be in accordance with the requirement of table 3-2-15.

Table 3-2-15 mm

Items		Standard range	Allowable limits	Remarks
	Planeness of wall at cut, ΔL_1	⩽1.0	⩽1.5	
	Clearance between window frame and cut, ΔL_2	⩽1	⩽2	

(END)

2.5 Cabin outfitting

2.5.1 The installation of door and door frame is to be in accordance with the requirements of table 3-2-16.

Table 3-2-16 mm

Items		Standard range	Allowable limits	Remarks
	Verticality of door frame, α	⩽4	⩽6	

Table 3-2-16(continued) mm

Items		Standard range	Allowable limits	Remarks
Clearance between wooden door and door frame, *b*	Clearance at lock side	⩽2	⩽3	
	Clearance at hinge side	⩽2	⩽3	
	Upper crack	⩽2	⩽4	
	Lower crack	⩽4	⩽6	
	Deviation of installed height of frame, ΔH	-3~10	-5~12	

(END)

2.5.2 Installation of lining and ceiling is to be in accordance with the requirements as defined in table 3-2-17.

Table 3-2-17 mm

Items		Standard range	Allowable limits	Remarks
	Verticality of lining, ***a***	⩽5	⩽7	
	Verticality of seam lining plate, ***b***	⩽3	⩽5	

Table3-2-17(continued) mm

Items		Standard range	Allowable limits	Remarks
Clearance between lining plates	Without strip, a_1	⩽0.3	⩽0.5	
	With strip, a_2	⩽1.0	⩽2.0	
	Sagging of ceiling plate, a	⩽3	⩽5	
Clearance between ceiling plates	Without strip, a_1	⩽1.0	⩽1.5	
	With strip, a_2	⩽1.0	⩽2.0	
	Misalignment of ceiling plate, a	⩽2.0	⩽2.5	
Deviation of clear height of ceiling		-10	---	

(END)

2.5.3 The application of deck covering is to be in accordance with the requirement as defined in table 3-2-18.

Table 3-2-18 mm

Items		Standard range	Allowable limits	Remarks
	Planeness of deck covering, ***a***	⩽2.5	⩽3.0	Per meter
	Planeness of plastic deck, ***b***	⩽2.5	⩽3.0	Per meter

3 MACHINERY INSTALLATION

3.1 Diesel main engine

The installation of diesel main engine and manufacture of fastening accessories are to be in accordance with the requirement as defined in table 3-3-1.

Table 3-3-1 mm

Items			Standard range	Allowable limits	remarks
Foundation	Deviation of web plate of engine foundation (longitudinal girder) from ship centerline		±4	±6	
	Planeness of face plate of engine foundation		⩽5	⩽10	Local, asoersed and small amount deviation from the limit is allowed
	Height deviation of face plate from ship baseline		⩽3	⩽5	
	Outward taper of face plate		1:1000	----	
Liner (including various liner of bearing seat)	Contact clearance of fixed liner before welding		⩽0.10	Not specified	Allowable inserting depth of 0.10 feeler to be not more than 10
		Contact ratio	⩾70%	⩾60%	To be every colored
		Blue oil points (25x25)		-------	
		Clearance	⩽0.05	-------	Allowable inserting depth of 0.05 feeler to be not more than 10
		Contact ratio	⩾70%	⩾60%	
		Blue oil points(25x25)	⩾3 points	-------	
		Clearance	⩽0.05	-------	Allowable inserting depth of 0.05 feeler to be not more than 10

Table 3-3-1(continued) mm

Items						Standard range	Allowable limits	Remarks
Liner (including various liner of bearing seat)	Taper of contact surface between tapered liners					⩽1:50	------	
	Liner thickness	Cast iron				⩾25	------	Liners in one group are not to be more than 2 pieces
		Steel				⩾15	------	
		Epoxy resin				-------	------	As per manufacture's specification
Installation	Fit of rea-mer bolt with hole	Hole diameter D	18~50	Max.	Clearance	0.005	------	
					Interference	0.005	------	
			>50~120	Max.	Clearance	0.014	------	
					Interference	0.005	------	

Table 3-3-1(continued) mm

Items			Standard range	Allowable limits	Remarks
Installation	Clearance between bolt head and foundation and clearance between nut and inner bottom plate after fastening		<0.05	_____	0.05 feeler is unable to be inserted
	Connection of output shaft flange of main engine with fore flange of intermediate shaft	Offset	⩽0.10	_____	D is outside diameter of measured flange
		Deflection	$\pm Dx10^{-4}$	_____	
Installation	Crank web deflection		_____	_____	In accordance with technical specification of manufacturer
	Web deflection when moment balancer are fixed at fore and aft ends or heavy fly-wheel is fixed at aft end		< 0.15xS/1000	Not specified	S is stroke of piston. *d* is diameter of main journal
	Distance from the measured position to the centerline of crank pin		_____	(s+d)/2	

(END)

3.2 Shafting

Installation of shafting and stern tube frame and shaft bracket are to be in accordance with the requirements as defined in table 3-3-2.

Table 3-3-2 mm

Items				Standard range	Allowable limits	Remarks
Centering of shafting	Shafting centerline	Long shafting (>15m)	Left or right	± 7	----	
			Above or below	± 10	----	
		Short shafting (⩽15m)	Left or right	± 3	----	
			Above or below	± 7	----	
	Deviation of shafting centerline from rudder centerline	Deadweight exceeding 100,000 tonnage		⩽5	⩽8	
		Deadweight exceeding 100,000 tonnage		⩽4	⩽6	
	Hole of stern tube frame and holes of shaft brackets	Deviation of bored center from calculated center		<0.10	----	
		Surface roughness R_a of bored circle		0.0063	0.0125	

Table 3-3-2(continued) mm

Items				Standard range	Allowable limits	Remarks
Centering of shafting	Requirement of circularity and cylindricality of boring	Bore	⩽120	⩽0.015		
			〉10~180	⩽0.020		
			〉180~260	⩽0.025		
			〉260~360	⩽0.030		
			〉360~500	⩽0.035		
			〉500~700	⩽0.040		
			〉700~900	⩽0.050		

Table 3-3-2(continued) mm

Items					Standard range	Allowable limits	Remarks
Installation	Deviation of actual load on bearing from calculated value				± 20%	Not specified	
	Alignment of shafting			Deflection ***a***	⩽ 0.10xD/1000	Not specified	D is flange diameter
				Offset ***b***	⩽0.10	Not specified	Or in accordance with alignment calculation (with holding-down bolt tightened)
	Displacement between tail shaft anti-corrosion sealing liner and rubber ring seat				± 3	Not specified	
Installation	Matching of propeller with cone part of tail shaft	Contact ratio			⩾75%	〉70%	
		Blue oil points(25 x25)	Key connection		⩾ 3 points	Not specified	
			Keyless connection		⩾ 3 points		

(END)

3.3 Auxiliary machinery

Installation of auxiliary machinery and fasteners is to be in accordance with the requirement as defined in table 3-3-3.

Table 3-3-3 mm

Items			Standard range	Allowable limits	Remarks
Category of auxiliary machinery	First class	Diesel generator set, steam turbine generator set, steam turbine auxiliary machinery			
	Second class	Fresh water pump, fresh water cooling pump, bilge pump, main engine sea water cooling pump, fire pump, fuel oil transfer pump, ballast pump, bilge and general service pump, emergency diesel generator set, air compressor, cargo oil pump,oil separator, hydraulic pump			The bilge pump may be listed in third class category if it is fixed on the common base

Table 3-3-3(continued) mm

Items			Standard range	Allowable limits	Remarks
Category of auxiliary machinery	Third class	Auxiliary machinery other than those of first class and second class			
Installation	Levelness of bed frame face plate		⩽2	⩽5	Local, dispersed and small amount deviation from the limit is allowed
	Clearance between liner and foundation	First class	⩽ 0.05		Allowable inserting depth of 0.05 feeler not more than 10
		Second class	⩽ 0.08	⩽0.12	
		Third class			
Installation	Contact area between liners	First class	⩾ 60%	⩾50%	
		Second class	⩾ 50%	⩾40%	
		Third class	Not specified		
	Outward taper of liner face		1:100		
	Thickness of liner		⩾12		

Table 3-3-3(continued) mm

Items				Standard range	Allowable limits	Remarks
Alignment	Rigid connection	Power $P \leqslant$ 37kw	Deviation	**⩽0.05**	**⩽0.07**	**D is flange diameter**
			Deflection	**⩽ 0.10xD/1000**	**⩽ 0.12xD/1000**	
		Power *p*>37kw	Deviation	**⩽0.08**	**⩽0.10**	
			Deflection	**⩽ 0.16XD/1000**	**⩽ 0.20xD/1000**	
	Flexible connection	Offset		**⩽0.10**	**⩽0.12**	
		Deflection		**⩽ 0.30xD/1000**	**⩽ 0.32xD/1000**	
Diesel generating set	Crank web deflection		Cold condition			**In accordance with technical specifications of manufacturer**
			Hot condition			

3.4 Deck machinery (END)

Installation of deck machinery and manufacture of fastening fittings is to be in accordance with the requirements as defined in table 3-3-4.

Table 3-3-4 mm

Items			Standard range	Allowable limits	Remarks
Category of deck machinery	A	Winch, windlass, anchor, capstan			
	B	Mooring winch, cargo winch			
	C	Machinery other than those of class A and class B			
Liner	Outward taper		1:100	1:50	
	Surface roughness R_a		0.0063	0.0125	
	Thickness	Class A,B	⩾12		
		Class C liner(steel, copper sheet)	2 sheets	3 sheets	Half liner is not allowed
Installation	Clearance between liner and bed frame	Class A	⩽0.06	⩽0.10	**Allowable inserting depth of feeler is not more than 10**
		Class B	⩽0.10	⩽0.20	
		Class C	Not specified		
	Contact ratio between liners	Class A	⩾60%	⩾50%	
		Class B	⩾50%	⩾40%	
		Class C	Not specified	Not specified	
	Number of fastening and locking nuts	Class A	2 pieces		
		Class B	2 pieces		
		Class C	Not specified		

3.5 Installation of steering gear and fastening liner

Installation of steering gear and manufacture of fastening liner is to be in accordance with the requirements as defined in table 3-3-5.

Table 3-3-5 mm

Items			Standard range	Allowable limits	Remarks
Plunger type	Interference of reamer bolt		0.10	0	
	Coaxal and positioning errors of plunger hydraulic cylinder		⩽10/100	Cylinder clearance within 75%	
	Alignment of assembled rigid coupling	Radial	⩽0.07	Not specified	
		Axial	⩽0.05		
Rotating vane type	Surface contact ratio of rudder stock with the shaft liner cone area of steering gear		⩾60%		
	Length of interference press trace of top end nut of rudder stock		0.6~1.0	Not specified	Length of press trace is to be in accordance with technical document of manufacturer
	Alignment of coupling of hydraulic pump	Radial	⩽0.07		
		Axial	⩽0.05		
liner	Contact ratio		⩾60%	⩾50%	
	Bed frame clearance		⩽0.05	Not specified	Inserting depth of 0.05 feeler is to be not more than 10

(END)

3.6 Fabrication and installation of piping

3.6.1 Fabrication of piping is to be in accordance with the requirements as defined in table 3-3-6.

Table 3-3-6 mm

Items		Standard range	Allowable limits	remarks
Length error of straight pipe	ΔL	± 3	± 6	
Length error of bent pipe	ΔL_1	± 3	± 6	
	ΔL_2	± 3	± 6	
	$\Delta \theta$	± 0.5°	± 1.0°	

Table 3-3-6(continued) mm

Items		Standard range	Allowable limits	Remarks
Length error of two direction bent pipe	ΔL_1	± 3	± 6	
	ΔL_2	± 3	± 6	
	ΔL_3	± 3	± 6	
	$\lvert \theta_1 - \theta_2 \rvert$	1°	2°	
Length error of three directional bent pipe	ΔL_1	± 3	± 6	
	ΔL_2	± 3	± 6	
	$\Delta \theta$	± 0.5°	± 1.0°	
Length error of branch pipe	ΔL_1	± 3	± 6	
	ΔL_2	± 3	± 6	
	ΔL_3	± 3	± 6	
	$\Delta \theta$	± 0.5°	± 1.0°	
Length error of cross piece	ΔL_1	± 3	± 6	
	ΔL_2	± 3	± 6	
	$\Delta \theta$	± 0.5°	± 1.0°	
Angular error of flange fixation to end of pipe, θ	D_N<150	30′	Not specified	
	$D_N \geqslant 150$	20′		
Deformation of flange face, ΔS	D_N<200	$\leqslant$ 1.0	Not specified	
	$D_N \geqslant 200$~450	$\leqslant$ 2.0		
Deflection of pipe, *d*	$D_N \geqslant 450$	$\leqslant$ 2.5		
	$D_N \geqslant 40$	$\leqslant$ 1.5L/1000	Not specified	

(END)

3.6.2 Pipe connection is to be made in accordance with the requirements as defined in table 3-3-7.

Table3-3-7 **mm**

Items			Standard range	Allowable limits	Remarks
Lap welding of steel pipe with flange	a		K+1	Not specified	K is leg size
	b		≤1.5	Not specified	
Grooves for butt welding of steel pipes	t≤3	a	<1	<3	t is pipe wall thickness
	3<t≤6	a	<2	≤3	
		θ	>30°	≤40°	
	t>6	a	2~2.5	--	
		θ	≥50°	60°	

Table 3-3-7(continued) **mm**

Items			Standard range	Allowable limits	Remarks
Sleeve joint of pipes		a	≤1.5	≤2.0	t is pipe wall thickness
		b	≤3t	Not specified	
		c		Not specified	
Branch pipe	t≤4	a	≤2	≤3	
	4>4	a	≤3	≤4	
		θ	>45°	≤50°	
Flange brazing		a	≤0.2	Not specified	

Table3-3-7(continued) **mm**

Items			Standard range	Allowable limits	Remarks
Flange soldering	**a**		≤0.2	**Not specified**	**t is pipe wall thickness**
	b		≤1.0		
Soldering of sleeve joint	**a**		≤0.2	**Not specified**	
	b		≤1.0		
	∫		≥5t		
Branch soldering	**t≤3**	**a**	≤1.0	≤2.0	**t is pipe wall thickness**
	3<t<6	**a**	≤1.5	≤3.0	
		θ	>45°	≤60°	

3.6.3 Bending of pipe is to be in accordance with the requirements as defined in table 3-3-8.

Table3-3-8 %

Items				Standard range	Allowable limits	Remarks
Circularity ratio of pipe, E E=(a-b)/ D_wx100 Where: a is maximum outside diameter of bending section, mm b is minimum outside diameter of bending section, mm	Steel and copper pipes	$R \leqslant 2D_w$	Cold bending	--	--	R is bending radius
			Hot bending	--	10	
		$2D_w < R \leqslant 3D_w$	Cold bending	--	10	
			Hot bending	--	8	
		$3D_w < R \leqslant 4D_w$	Cold bending	--	10	
			Hot bending	--	8	
		$R > 4D_w$	Cold bending	--	10	
			Hot bending	--	5	

Table3-3-8 %

Items				Standard range	Allowable limits	Remarks
D_w is actual outside diameter of pipe, mm	Alumium brass pipe	$R \leqslant 2D_w$	Cold bending	--	15	
		$2D_w < R \leqslant 3D_w$	Cold bending	--	10	
		$3D_w < R \leqslant 4D_w$	Cold bending	--	10	
		$R > 4D_w$	Cold bending	--	8	

Table 3-3-8(continued) %

Items				Standard range	Allowable limits	Remarks
Wall thinckness reduction ratio, F $F=t-t_1/tx100$ Where: t is pipe wall initial thickness, mm t_1 is wall thickness after bending, mm	Steel pipe	$R \leqslant 2D_w$	Cold bending	--	--	R is bending radius
			Hot bending	--	20	
		$2D_w < R \leqslant 3D_w$	Cold bending	--	25	
			Hot bending	--	10	
		$3D_w < R \leqslant 4D_w$	Cold bending	--	20	
			Hot bending	--	5	
		$R>4D_w$	Cold bending	--	15	
			Hot bending	--	5	

Table3-3-8(continued) %

Items				Standard range	Allowable limits	Remarks
Wall thinckness reduction ratio, F	Capper pipe	$R \leqslant 2D_w$	Cold bending	--	--	
			Hot bending	--	20	
		$2D_w < R \leqslant 3D_w$	Cold bending	--	30	
			Hot bending	--	15	
		$3D_w < R \leqslant 4D_w$	Cold bending	--	25	
			Hot bending	--	10	
		$R>4D_w$	Cold bending	--	20	
			Hot bending	--	10	

Table 3-3-8(end) %

Items				Standard range	Allowable limits	Remarks
Wall thinckness reduction ratio, F	Aluminum brass	$R \leqslant 2D_w$	Cold bending	--	25	
		$2D_w < R \leqslant 3D_w$	Cold bending	--	25	
		$3D_w < R \leqslant 4D_w$	Cold bending	--	20	
		$R > 4D_w$	Cold bending	--	15	
Bucking height of pipe bend, h				$\leqslant 3/100x D_w$	Not specified	h is backing height, mm D_w is outside diameter of pipe, mm

3.6.4 Pipe fixing is to be proceeded in accordance with the requirements as defined in table 3-3-9.

Table3-3-9 mm

Items			Standard range	Allowable limits	Remarks
Hole	Upper deck, shell plating and bulkhead	Roughness	0.4	0.8	D is diameter of hole
		Dimensional tolerance	$\leqslant D/100$	$\leqslant D/50$	
	Others	Roughness	0.8	1.5	
		Dimensional tolerance	$\leqslant 3$	$\leqslant 5$	
Clearance of sleeve type penetration piece, a			>2	3	

Table3-3-9(continued) mm

Items			Standard range	Allowable limits	Remarks
Alignment	Deflection a	$D_N \leqslant 100$	$\leqslant 1.5$	--	
		$100 < D_N \leqslant 200$	$\leqslant 2.0$	--	
		$200 < D_N \leqslant 400$	$\leqslant 3.0$	--	
		$D_N > 400$	$\leqslant 4.0$	--	
	Offset, b		$\leqslant 1.5$	Not specified	
$a = a_1 - a_2$					
Offset of flange bolt hole, a			<1	Not specified	

Table3-3-9(continued) mm

Items		Standard range	Allowable limits	Remarks
Alignment of clamped pipes	Offset of pipe center, a	<3	<5	
	Clearance between pipe ends, L	<10	Not specified	
Pipe clamp and fastening	Clearance of U-shape pipe clamp or flat steel pipe clamp, a	1~3	Not specified	
	Length of extrusion of bolt thread after fastening, L_1	(1~4)x pitch	--	

Table 3-3-9(continued) mm

Items		Standard range	Allowable limits	Remarks
Distance between pipes and pipe fittings	Distance between parallel pipes, crossover pipes and two adjacent pipes(including fittings), a	>20	>10	
	Distance between outside surface of insulated pipe and adjacent pipe fittings, a_1	>30	Not specified	
	Distance between adjacent parallel valves and handwheel, a_2	⩾30	Not specified	
	Assembling offset of pipe anti-abrasion strip from bracket, b	⩽1/3L	Not specified	
Distance between brackets	Offset of bolt hole center on bracket with that on flat steel strip pipe clamp, △L	0~2	Not specified	
	Offset of bolt hole center on bracket, a	± 2	Not specified	

3.6.5 Mounting pipe extension rod is to be in accordance with the requirements as defined in table 3-3-10.

Table3-3-10 mm

Items			Standard range	Allowable limits	Remarks
	Clearance between extension rod(operating rod)and bearing, a	D>25~35	0.5~1.5	--	D is diameter of extension rod
		D>35	0.5~2.0	--	
	Coaxality of extension rod(per 5m)		⩽10	--	
	Offset of extension rod from value rod axis line		⩽10	--	
	Mounting angle of deck support		$\leqslant 1^0$	--	

4 ELECTRIC INSTALLATION

4.1 Cable laying

Cable laying is to be carried out in accordance with the requirements as defined in table 3-4-1.

Table3-4-1 mm

Items	Standard range	Allowable limits	Remarks
Number of layers	2 layers in general(or thickness⩽50)	--	
Breadth	⩽200	--	
Distance to heat source	⩾100	No limit if effective means are adopted	
Distance to moist bulkhead	⩾20	--	
Distance to fire-resisting bulkhead and deck	⩾20	--	To thermal insulation

Table3-3-9(continued) mm

Items		Standard range	Allowable limits	Remarks
Distance between pipes and pipe fittings	Distance between parallel pipes, crossover pipes and two adjacent pipes(including fittings), a	>20	>10	
	Distance between outside surface of insulated pipe and adjacent pipe fittings, a_1	>30	Not specified	
	Distance between adjacent parallet valves and handwheel, a_2	⩾30	Not specified	
	Assembling offset of pipe anti-abrasion strip from bracket, b	⩽1/3L	Not specified	
Distance between brackets	Offset of bolt hole center on bracket with that on flat steel strip pipe clamp, △L	0~2	Not specified	
	Offset of bolt hole center on bracket, a	± 2	Not specified	

Table 3-4-1(end) mm

Items		Standard range	Allowable limits	Remarks
Distance to double bottom and lubrication oil tank and fuel oil tank		⩾50	--	
Distance of cable trunk to bulkhead and deck		⩾30	--	
Spacing between fixing brackets	Curved space	⩽250	--	
	Straight space	⩽300	--	
Percentage of cable laid through pipe and trunk		⩽40%	--	
Minimum inner radius of bend	D⩽25, thermoplastic material and elastic material insulated metalic sleeve, armoured, braided and hard metallic sleeved cable	4D	--	D is cable outside diameter
	Others	6D	--	
Length of cable core entering equipment	Lighting fixture	⩾150	--	
	Switch, receptacle, connecting box, alarm bell, etc.	120	--	

4.2 Electric equipment installation

4.2.1 Electric equipment inside the accommodation spaces are to be installed according to the height requirements as defined in table 3-4-2.

Table 3-4-2

mm

Items	**Standard range**	**Allowable limits**	**Remarks**
Concealed switch in cabin and passage	**1300~1600**	**--**	**From center to floor**
Watertight switch in cabin and inner passage	**1300~1600**	**--**	
Watertight receptacle, receptacle with switch	**1300**	**--**	
Receptacle for desk lamp, telephone set, radio and TV	**150**	**--**	**From center to desk top**
Receptacle for wall fan	**1800**	**--**	**From center to floor**
Concealed receptacle at foot height	**300**	**--**	
High and low voltage receptacles	**1300**	**--**	

Table 3-4-2(end) **mm**

Items		**Standard range**	**Allowable limits**	**Remarks**
Berth lamp	**On side wall 300 to 400 from head of bed**	**750**	**--**	**From center to bed plate**
	Middle over head side			
Wall lamp		**1700**	**--**	**From lower edge to floor or from ceiling to 200 above upper edge**
Mirror lamp		**20~100**	**--**	**Above mirror**
Wall fan		**1800**	**--**	**From center to floor**
Ceiling fan		**1900**	**--**	**From lowest point of rotation to floor**
Fire alarm call point		**1400**	**--**	**From center to floor**
Wall-mounted telephone		**1400**	**--**	
Loud-speaker(with potentialmeter), clock		**1800**	**--**	

4.2.2 Electric equipment installed in places outside accommodation spaces are to be in compliance with the height requirements as defined in table 3-4-3.

Table3-4-3 mm

Items	Standard range	Allowable limits	Remarks
Distribution panel, starter and control box	1800	--	From upper side to floor(or 1.2 m from lower side to floor)
Push button box	1400	--	From center to floor
Emergency push button box	1400	--	
Switch, switch with receptacle	1400	--	From center to floor, and 250 in between when installed upper and down
External passage lamp	150~200	--	From center to the deck above
Wall-mounted telephone	1400	--	From center to floor
TV antenna converter	250	--	To TV, measured from TV chassis(fixed below TV)
	1500	--	To floor (fixed side TV)
TV jack	150	--	To TV chassis

5 PAINTING

5.1 Pretreatment of steel surface

5.1.1 Pretreatment of steel surface is to be performed in accordance with the requirements as defined in table 3-5-1.

Table 3-5-1

Items			Standard range	Allowable limits	Remarks
Shot blasting	Steel plate of t⩾6mm	Cleanness	Sa 2.5 class	--	
		Roughness	Medium class	--	GB/T 13288
	Steel sections of t⩾4mm	Cleanness	Sa 2.5 class	Sa 2 class	
		Roughness	Medium class	--	GB/T 13288
Picking	Steel plate of t⩽6mm, steel sections ⩽ 4mm, steel outfitting	Cleanness	No scale No rust No grease No dirt	--	
Abrasive blasting	Steel plate of any size steel sections of any size	Cleanness	Sa 2.5 class	--	
		Roughness	Medium class	--	GB/T 13288
	Steel outfitting	Cleanness	Sa 2.5 class	Sa 2 class	
		roughness	Medium class	--	GB/T 13288

5.1.2 Application of shop primer is to be in accordance with the requirements as defined in table 3-5-2.

Table3-5-2 mm

Items		Standard range	Allowable limits	Remarks
Type of paint	Zinc primer	--	--	Approved by classification society in accordance with painting scheme approved by shipowner
	Zincless primer			
Film thickness	Zinc primer	13~18	⩾12 ⩽30	
	Zincless primer	20~25	⩾18 ⩽40	

5.2 Secondary derusting

Cleanness after secondary derusting is to be in compliance with the requirements as defined in table 3-5-3.

Table 3-5-3

Items				Standard range	Allowable limits	Remarks
Position		Paint type	Surface treatment			
Shop primer damaged area, such as weld area, line and spot heating area and naturally exposed area	Shell plating and exterior explosed location	Conventional paints[1)], chlorinated rubber paint	Abrasive blasting	Sa 2class	--	
			Power tool	St 2~3 class	--	
		Epoxy resin paint, vinyl resin paint, polyure-thane paint	Abrasive blasting	Sa 2.5 class	--	
			Power tool	St 3 class	--	
		Epoxy-tar paint	Abrasive blasting	Sa 2.5 class	Sa 2 class	
			Power tool	St 3 class	--	
		Inorganic zine paint	Abrasive blasting	Sa 2.5 class	--	

Table 3-5-3(continued)

Items				Standard range	Allowable limits	Remarks
position		Paint type	Surface treatment			
Shop primer damaged area, such as weld area, line and spot heating area and naturally exposed area	Interior space	Conventional paints, chlorinated rubber paint	Abrasive blasting	Sa 2class	--	
			Power tool	St 2 class	--	
		Epoxy resin paint, vinyl resin paint, epoxy-tar paint	Abrasive blasting	Sa 2class	--	
			Power tool	St 2~3 class	--	
		Inorganic zine paint	Abrasive blasting	Sa 2.5 class	--	

Table 3-5-3(continued)

Items				Standard range	Allowable limits	Remarks
Position		Paint type	Surface treatment			
Shop primer damaged area, such as weld area, line and spot heating area and naturally exposed area	Interior of liquid tank(excluding fuel tank)	Conventional paints	Abrasive blasting	Sa 2class	--	
			Power tool	St 2~3 class	--	
		Epoxy resin paint, vinyl resin paint, polyurethane paint, epoxy-tar paint	Abrasive blasting	Sa 2.5 class	--	
			Power tool	St 3 class	--	
		Inorganic zine paint	Abrasive blasting	Sa 2.5 class	--	
	Fuel tank	Conventional paint	Power tool	St 2 class	--	

Table 3-5-3(end)

Items				Standard range	Allowable limits	Remarks
position		Paint type	Surface treatment			
Surface with intact shop primer	Product tanker hull surface except cargo tank	Any paint	Abrasive blasting, power tool	Remove powderly rust, grease and dirt	--	
	Interior of cargo tank of product tanker	Special paints for cargo tank of product tanker	Abrasive blasting	Remove over 70% of previously applied primer	--	
Note: 1)Conventional paints include oil-based paint, oil-modified synthetic resin based paint and bituminucus paint. For fuel oil tank and lubrication oil tank, conventional paints imply those temporary protective paints based on petroleum resin and castor oil and conventionally used shop primer. In case phenolic paints is used for potable water tank, the quality control requirements are to be the same as those for the application of epoxy resin paint.						

5.3 Surface cleaning

Surface cleaning before painting is to be performed in accordance with the requirements as defined in table 3-5-4.

Table 3-5-4

Items		Standard range	Allowable limits	Remarks
Moisture	Before applying any paint	Invisible to naked eye	--	
Salt	Before applying any paint	Invisible to naked eye	--	
Grease	Before applying inorganic zinc paint	**Invisible to naked eye**	--	
	Before applying paints other than inorganic zinc paint	Remove	With trace remained	
Dust	Before applying any paint	Remove	With trace remained	

Table 3-5-4(continued)

Items			Standard range	Allowable limits	**Remarks**
Zincic sale	Before applying inorganic paint		Remove	With slight trace remained	
	Before applying paint other than inorganic zinc paint		Remove	With trace remained	
Dust of gas cutting and welding	Before applying inorganic zinc paint		Remove	With slight trace remained	
	Before applying paint other than inorganic zinc paint		Remove	With trace remained	
Chalk marking	Before applying inorganic zinc paint		Remove	With slight trace remained	
	Before applying chlorinated rubber paint, epoxy resin paint, vinyl resin paint and polyurethane resin paint		Remove	With trace remained	
	Before applying inorganic paint		Basically cleaned	--	
Paint marking	Before applying inorganic zinc paint		Remove	With slight trace remained	
	Before applying chlorinated rubber paint, vinyl resin paint and polyurethane resin paint	In case the marking paint is compatible	No need to remove	--	
		In case the marking paint is not compatible	Remove	With trace remained	
	Before applying conventional paint		No need to remove	--	

5.4 Quality of coating

The quality of the coating is to be in compliance with the requirements as defined in table 3-5-5.

Table 3-5-5

Items			Standard range	Allowable limits	Remarks
Surface with high decoration requirement(exterior surface of superstructruue, exposed surface of wheelhouse, accommodation cabins and interior passage)	Defect	Miss-out painting, bubble cavity, crackle, dry particles of paint	None	--	
		Flowtrace, brush mark, ripple	Not obvious	Slight	
	Color		In conformity with requirement	--	
Surface with certain decoration requirement(shell plating, exposed deck, engine room and stores)	defect	Miss-out painting, bubble cavity, crackle	None	--	
		Flowtrace, ripple	Not obvious	Slight	
	Color		Not obviously different from requirement	--	
Surface without decoration demand(such as cargo hold, cargo tank, void space and cofferdam etc.)	Defect	Miss-out painting, bubble cavity, crackle	None	--	
		Flowtrace, ripple	Not abvious	Not serious	

5.5 Film thickness of coating

Film thickness of coating is to in compliance with the painting specification. The deviation of the thickness of the film is to be in compliance with the requirements as defined in table 3-5-6.

Table 3-5-6

Items		Standard range	Allowable limits	Remarks
Distribution of film thickness	Film thickness of over 85% measured points	Up to required thickness	--	For cargo tank of product tanker, the thickness at over 90% measured points is to be up to the required film thickness, with film thickness at remaining measured pants to be up to 90% required thickness
	Film thickness of remaining measured points	Up to 85% required thickness	--	